# PUERPERAL INFECTION, WITH SPECIAL REFERENCE TO THE VALUE OF BLOOD CULTURES IN THE VARIOUS STAGES OF THIS CONDITION, AND TO THE QUESTION OF "AUTOINFECTION".

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# I N D E X.

# I N T R O D U C T I O N.

Since the introduction of aseptic and antiseptic methods into Midwifery the incidence of Puerperal Fever has diminished enormously. But when we compare the results obtained in Midwifery, with those obtained in Surgery it must be admitted that the improvement is not proportionate. Still sepsis does occur in cases where every precaution has been taken. We have however inherited the view that sepsis is preventible in every case, that carelessness on the part of the accoucheur is responsible for its occurrence, and that, should a case become infected the essential part of the treatment is to take steps to ensure the complete emptying of the Uterus.

Therefore, when new ideas are brought forward and the suggestion made that patients may carry in the Vagina organisms which may give rise spontaneously to sepsis in the Puerperium and that more harm than good may be done by removing fragments of placenta from an already infected Uterus, it is a long time before these suggestions are seriously considered.

Work has been done in the endeavour to solve the first-mentioned problem, since the end of last century, chiefly in Germany and in America. The second debatable point/

point - that the hitherto recognised treatment of infected cases by douching, and removing remnants of placenta etc. has no sound foundation in Pathology - was brought forward in Germany in 1910. American observers then became interested and began to investigate the matter. This country, always a conservative one, has only recently begun to consider the question. At a meeting of the Obstetrical Society in Edinburgh in 1923, Professor Watson brought forward this view[78] and raised a lively discussion.

Certainly both questions, if they offer any explanation of the obstinately high mortality statistics, are well worth studying. In Scotland more than six pregnant patients in every 1000 die from diseases or accidents of childbirth and 25-50% of these deaths are due to Puerperal Fever;[86] i.e. about 2000 patients die annually in the United Kingdom from this disease, and there is no indication that this high mortality is decreasing.

To enter thoroughly into these problems it is necessary to consider briefly the pathology and means of spread of the infection.

It has always been emphasised that Puerperal Infection is a form of wound infection, but it is wound infection with a very special pathology. In proportion to its size the pregnant uterus has an enormous blood supply and the lymphatic drainage in pregnancy and the puerperium is particularly well developed. It is necessary that this should be the case,/

case, because the lymphatics play an important part in removing the products of involution of the uterus, but it is also a danger from the point of view of facilitating the dissemination of infection. We have also to consider the fact that at one period, while the placenta is separating, the large venous channels in the uterine wall are in direct communication with the uterine cavity. Normally, as soon as the placenta is expelled, the uterus contracts down and obliterates the lumen of these veins and large thrombi close their mouths. If any infection is present, and if in its presence anything is done to disturb these protecting thrombi, the dangers are obvious. In no other inflammatory condition is there such a direct communication between an infected cavity and the general circulation.

These facts apply equally well to abortion and to full-time labour, and in abortion, particularly when incomplete, the period of open communication with the venous system is prolonged, though the lymphatic and blood supplies are not so well developed as during full-time labour.

These are the considerations which render the question of treatment much less simple than in the case of an ordinary infected wound.

In recent years the morbid anatomy and the method of spread of the infection have been admirably worked out by Halban and Köhler[25] on a series of 163 fatal cases - /

cases - 64 post partum and 99 post abortum. These observers have shown that the infection may start from a perineal, a vaginal, or a cervical tear, or most usually from the interior of the body of the uterus itself. The post-mortem appearance of the interior of the uterus varies. In many cases (20%) it is lined by a perfectly smooth normal-looking endometrium with or without an apparently harmless piece of placenta attached to the wall; or it may show a patchy inflammation with fibrinous exudate, not necessarily involving the retained piece of placenta or the placental site. Again, the entire endometrium may be covered with a purulent exudate beneath which ulcers extend deeply into the muscular wall - an extreme stage of "septic endometritis". Or again the uterus may be large, soft and flabby, its ulcerated walls covered with ragged, decomposing tags of endometrium and its cavity filled with dark-green semi-fluid contents with a loathsome odour, the result of putrefaction of blood clots, pieces of placenta, and uterine secretion. This is an advanced stage of the so-called "putrid endometritis". In the opinion of the observers this is due to <u>secondary</u> invasion of the uterus by anaerobes. All stages may be found between this and "septic endometritis", and while the former is usually due to an infection with anaerobes and saprophytes and the latter to recognisedly pathogenic organisms (the chief being streptococci) yet a mixed/

mixed infection is apparently possible and frequent, and, as they have shown, a general Streptococcal infection may be the cause of death while the uterus is in the condition of "Putrid Endometritis". The condition of the interior of the uterus does not always give the key to the character of the infection.

From this infected cavity the infection may spread in three different ways, either alone or combined one with another. These ways are (a) by the blood vessels (veins), (b) by lymphatics, (c) by the tubes to the peritoneal cavity. A combination of (a) and (b) is most common. (c) is more frequent after abortion than after full-time labour (10 cases to 2). Blood spread is quite common after abortion though Bumm[11] has suggested that there is little danger of this in early pregnancy because the veins then are small. 17 out of 99 abortion cases had a purely blood-spread infection, and in other 30 the veins were involved though not alone.

(a) Spread by way of Veins.

Infection spreads from the interior of the Uterus through the veins of the Uterine wall. On section the thick muscular wall frequently shows multiple small abscess cavities, and the veins in its substance are large and contain fluid blood or infected thrombi. Thence the process reaches either the Pampiniform Plexus and the Ovarian Vein, or the Parametrian/

Parametrian Venous Plexus, the Hypogastric Vein and the Common Iliac Vein. Which system of veins is affected, depends on the point of entry of the infection, but the observers could trace no definite connection between any retained piece of placenta and the veins involved. When the larger veins are cut open their endothelial lining may merely be roughened with perhaps a clot adhering to it, or they may contain a bright red thrombus with yellow pus specks throughout it, or they may be filled entirely with yellow-green pus, from which during life organisms could continually reach the circulation.

Periphlebitis with abscess formation may occur at any point. These abscesses frequently involve the ovary, or they may rupture into the peritoneal cavity. But if the blood infection takes its own course the next stage is the formation of Metastases. These frequently occur in the skin and in the periarticular tissues, where they give rise to transient reddened swellings and sometimes to disintegration of the soft parts and dislocation of joints. They occur chiefly, however, in the lungs, and in the lower lobes of these. If an abscess reaches the pleura, it is liable to rupture and result in Empyaema.

If the emboli are small, e.g. composed of minute clumps of bacteria, they are able to pass through the lungs and reach the left heart where they cause endocarditis, or passing still further on, they give rise to/

to multiple small abscesses in the cortex of the Kidney and to infarcts in the Spleen.

The process as here traced out may heal at any point, though once the veins have become filled with breaking-down purulent blood-clot, it is not to be expected.

It is noteworthy that in this series the observers did not have a single case of blood-spread infection where there was not a definite phlebitis, i.e. there was no case of pure Septicaemia. This incidentally tends to confirm Schottmüller's contention[66] that in these cases the organisms do not multiply in the blood but are continually being washed into the circulation from some infected focus in direct communication with it, e.g. the veins, the heart valves, the uterus itself. In the blood stream they are more or less rapidly destroyed and replaced by a fresh invading force.

(b) Lymphatic Spread.

Halban and Köhler have been able to demonstrate lymphatic spread through the uterine wall to the cellular tissue of the Parametrium in no less than 115 of their cases. In 48 of these this was the sole method of spread. The uterine wall in these cases is hard and occasionally shows abscesses, multiple or single which may rupture and terminate the case rapidly by causing peritonitis. If, however, this does not happen, the infection/

infection reaches the enormous plexus of lymphatics in the parametrium. Here the process often halts. A hard inflammatory mass forms, which gradually recedes, or am abscess develops, is opened, and the patient recovers. When, however, the process continues the cellulitis may spread up behind the peritoneum on either side of the Vertebral Column or behind the Colon, till it reaches the Diaphragm and huge collections of pus result, which are very difficult to diagnose. Or the organisms reach the Thoracic Duct directly by spread along the main lymphatics. Thence they gain the Superior Vena Cava and the general circulation.

The emboli in this class of case, are usually microscopic clumps of bacteria, hence the relatively high frequency of Endocarditis in these as compared with the blood-spread cases.

The lung changes take the form of bronchitis with abscesses, which the observers regard not as embolic, but rather as being secondary to the bronchitis.

These lymphatic cases, more often than the blood-borne cases, show changes in serous cavities - meningitis with multiple abscesses in the Pia Mater, pericarditis, pleurisy, synovitis (c.f. the primarily periarticular changes which are more common in blood-spread infection) and peritonitis. That general peritonitis in Puerperal patients is particularly fatal, and that operation is usually hopeless is not surprising in view of the post-mortem findings. Though

many/

many cases are of the diffuse purulent type the loculated form is much more frequent. Coils of intestine are glued together, with abscess cavities between. Into these the bowel may rupture; or abscesses form between the ascending or the descending colon and the abdominal wall, and spreading upwards eventually form huge sub-phrenic abscesses.

The lymphatic form where peritonitis also is present is very rapidly fatal.

(c) Spread by way of the Tubes.

Fatal spread by the tubes alone is least common and is chiefly found in abortion cases (10 cases compared with 2 after full-time labour). The cause of death in these cases is peritonitis. The tubes are reached by direct surface spread from the endometrium. Halban and Köhler emphasise the fact that the peritonitis is not the result of rupture of a pus tube unless an old inflammatory condition has been present and the ostium is already closed. The inflammatory process in these fatal cases always spreads too rapidly to allow the fimbriae to become glued together. There is no enlargement in the tubes beyond simple inflammatory swelling and nothing resembling the distension of an ordinary pyosalpinx is found in the fatal cases where this is the sole method of spread. The chief change is in the peritoneum and that has been described above. These cases are most rapidly fatal because the infection/

infection reaches the peritoneum at once.

Combinations of (a), (b) and (c) occurred in almost half the cases (71 out of 163), and the resulting picture varied in its details accordingly. (a) plus (b) is the most common combination; (b) plus (c) is next; Peritonitis may be associated with any, and was present in 69 out of 163.

As has been pointed out the process may recede at various stages and the patient recovers, always with damaged organs, e.g. Pelvic Cellulitis whether lymphatic or phlebitic in origin can recede, fibrous tissue forms, contracts and results in distortion of the pelvic organs and chronic pain. Or, tiny pus cavities are left, walled off by fibrous tissue but ready to cause a fresh outbreak of sepsis at the next pregnancy. Polak[49] suggests this as one form of "Autoinfection".

Whether the patient recovers or not, these are all severe cases with some definite lesion outside the uterus which is probably recognisable on Vaginal examination. In the slighter cases the infection is limited to the uterus and the question as to whether the temperature in these cases is due to actual inflammation of the uterine tissues or merely to toxic absorption from putrefying remnants of blood clot will be discussed later.

With this brief description of the many easy paths by which organisms can pass beyond the Puerperal uterus, let us next consider the method of introduction of the infecting agent into the genital tract.

## AUTOINFECTION.

In the majority of cases there has been during labour some interference, however slight, which may account for the presence of pathogenic organisms in the tract. But cases do occasionally develop fever in the puerperium though they have never even been examined. Where have the organisms come from? Have they been present in the Vagina during pregnancy? Have they ascended from the Vulva after labour?

The definition of Autoinfection varies within wide limits according to different authorities, and the opinion as to its occurrence or otherwise depends largely on the definition. Ahlfeld's definition[1] is widest. He includes cases where the uterine infection is a metastasis from an infective focus elsewhere in the body.

Further he regards the case as one of autoinfection if the organisms were anywhere on the patient's body and became introduced into the Vagina. According to this definition autoinfection frequently occurs.

Other authors, Bondy[7], Aschoff, Zangemeister, regard a case as one of Autoinfection if the organisms were in the genital tract before labour, and they do not strictly differentiate Vaginal from Vulvar organisms. Therefore autoinfection in their opinion occurs if the patient becomes infected from the Vulva.

Bumm/

Bumm and Sigwart[12] regard such cases as infection from outside, the organisms having been introduced artificially by some interference. As will be seen later, organisms do ascend from the Vulva to the Uterus after delivery, but in individual cases it is difficult to tell whether interference carried them up into the Vagina during labour, or whether they rose spontaneously after delivery, or whether they did not originally reach the Vulva by some artificial means, either during or after labour. The question of the spontaneity of the infection is the important one. Therefore investigations are best confined to the organisms present in the Vagina before delivery.

## VAGINAL STREPTOCOCCI.

A. In non-pregnant patients.

As the Streptococcus is the most important cause of severe Puerperal Fever, much work has been done in order to find out whether it occurs in the normal Vagina, pregnant and non-pregnant. The matter seems simple enough and yet it is still open to discussion. A small group of observers, the chief being Williams[82], declare that, provided the technique is such as to avoid Vulvar contamination, Streptococci are/

are never found in the normal Vagina at least in pregnancy. Another large group have brought forward evidence to show that Streptococci are fairly frequently present in the Vagina, but the question of their pathogenicity remains an open one.

All of this part of the subject is necessarily vague, because, even at the present day, relatively little is known as to the variations in cultural reactions and in virulence of the group of organisms known as Streptococci. Various arbitrary classifications have been used. In 1903, Schottmüller[67] suggested a division into three groups:-

(1) Streptococcus Erysipelatis - producing haemolysis of blood corpuscles when grown on Blood Agar.

(2) Streptococcus Viridans - producing greenish colonies but no clear haemolytic ring on the same medium.

(3) Streptococcus Mucosus - non-haemolytic or producing only slight haemolysis, and growing in a slimy film on Blood Agar. This organism is probably the Pneumococcus.

And later he added a fourth (4) Streptococcus Anaerobius or Putridus - an obligate anaerobe producing foul gases in culture.

In 1905, Gordon[23] evolved a system of classification depending on nine different cultural tests including the fermentation of seven different carbohydrates. If strictly adhered to, this system would lead/

lead to several hundreds of varieties. In 1906 Andrewes and Horder[1] revised this classification and showed that, neglecting minor variants, there were seven main varieties of the organism - Streptococcus Equi, Mitis, Pyogenes, Salivarius, Faecalis, Anginosus, and the Pneumococcus. The last five only, and their variations, are found in pathological lesions in man. In recent years Holman's classification - a simplified form of Gordon's - has been widely adopted. He divides the organisms into haemolytic and non-haemolytic and then further subdivides them according to their ability to ferment four carbohydrates - Lactose, Salicin, Mannite, and Inulin. His groups are shown in the following table:-

| | S. Infrequens. | S. Haemolyticus I. | S. Pyogenes. | S. Anginosus. | S. Haemolyticus II. | S. Haemolyticus III. | S. Equi. | S. Subacidus. | S. Faecalis. | S. non-haemolyticus I. | S. Mitis. | S. Salivarius. | S. non-haemolyticus II. | S. non-haemolyticus III. | S. Equinus. | S. Ignavus. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Haemolysis | + | + | + | + | + | + | + | + | - | - | - | - | - | - | - | - |
| Lactose | + | + | + | + | - | - | - | - | + | + | + | + | - | - | - | - |
| Mannite | + | + | - | - | + | + | - | - | + | + | - | - | + | + | - | - |
| Salicin | + | - | + | - | + | - | + | - | + | - | + | - | + | - | + | - |
| Inulin | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

Most of the workers on Vaginal streptococci, however, have failed to classify the organisms found, or at most have been content with dividing them into haemolytic and non-haemolytic varieties.

I myself have had the opportunity of making cultures from the Vagina in a series of Gynecological cases from Ward 34 of the Edinburgh Royal Infirmary, and from a series of pregnant patients attending the Antenatal clinics at the Royal Maternity Hospital.

In the former series the cultures were taken immediately before operation. The patient was put in the lithotomy position, the Vulva which had been shaved was painted with iodine. A sterile speculum was inserted, either Cusco's Bi-valve or Sym's and a smear taken from the Cervix with a sterile throat swab. If necessary the cervix was pulled down with a sterile vulsellum for this purpose. Two serum-agar plates were immediately inoculated with the material on the swab, and incubated. The colonies were examined in 48 hours, the different organisms identified, and Streptococci if present were isolated in pure culture in serum broth and classified according to Holman's method. The presence or absence of haemolysis was determined by growing the organisms on blood agar plates. The result was not regarded as positive unless there was a distinct clear halo round each colony. Hiss's Serum Water containing the appropriate Carbohydrate/

Carbohydrate and coloured with Litmus was the medium used for the fermentation test. This medium was inoculated with about 1 cc. of a serum broth culture of the organism and incubated for 5 - 7 days before the result was read. Fermentation was shown to have taken place, by the production of acid and consequent change of colour from blue to pink, and also by the coagulation of the serum. The cultures were always subsequently examined, to be certain that there was no contamination present.

The Bile-Solubility test[29] was also used to differentiate the organisms from Pneumococci. A 10% solution of Sodium Taurocholate in Normal Saline was made and autoclaved. One-tenth volume of this solution was added to a broth culture of the organism. If the organisms were still present after standing for 24 hours, they were true Streptococci.

Seventy patients were examined in this way. A rough classification of these cases is appended. Eleven of these, however, had uterine pregnancies and were cases of abortion and will therefore be considered later. Of the remaining 59 cases, 36 had organisms of some sort in the Vagina and the other 23 yielded sterile cultures (Anaerobic methods were not used, thus accounting for the absence of such organisms).

Of the 59, further, 9 had a history of chronic or previous inflammation,* or of some cause for organisms being present, e.g. the wearing of a pessary. Organisms/

* Cases 17, 24, 32, 65, 66, 67, 68, 69, 70.

Organisms were not grown from all of these, probably because suitable media were not used for growing, e.g. Gonococci, but 4 of them yielded Streptococci.

Out of the remaining 50 non-pregnant cases, which may be regarded as non-infected cases, 21 were sterile and 29 (58%) had organisms in the Vagina. Twenty of these 50 cases were multiparae with marked deficiency of the pelvic floor and of these 16 (80%) had organisms in the Cervix. In only 13 (43%) of the remaining 30 cases was a growth obtained.

Further, out of the 50 cases, 15 (30%) had Streptococci present in the Vagina, and 9 of the 15 (60%) belonged to the group of 20 where the pelvic floor was deficient. Therefore 45% of the cases with deficient pelvic floor had streptococci in the Vagina, as compared with 20% of all the other 30 cases.

A lacerated cervix alone is not necessarily infected, but if it is combined with a lax pelvic floor and a certain degree of cystocele it is almost certain to contain organisms, and frequently Streptococci. The frequency with which Streptococci were present along with B. Coli suggests that the infection comes directly from the Vulva as is to be expected.

The organisms found in this series of cases were these:- Staphylococcus Albus, Diphtheroid Bacilli, B. Coli, B. Proteus, Streptococci and large Gram-positive non-sporing bacilli with rounded ends.

The Streptococci found were classified by Holman's method with the following results:-

| Case No. | Haemolysis. | Lactose. | Mannite. | Salicin. | Inulin. | Type. |
|---|---|---|---|---|---|---|
| 13 | - | - | + | + | - | S. Non-haemoylticus II. |
| 14 | - | + | + | + | - | S. Faecalis. |
| 17 | - | + | - | + | - | S. Mitis. |
| 24 | - | + | - | + | - | S. Mitis. |
| 32 | - | + | + | + | - | S. Faecalis. |
| 34 | - | + | - | + | - | S. Mitis. |
| 39 | - | + | + | + | - | S. Faecalis. |
| 40 | ?(not typical) | + | - | + | - | S. Mitis. |
| 41 | - | + | - | - | - | S. Salivarius. |
| 43 | - | + | + | + | - | S. Faecalis. |
| 44 | - | + | - | + | - | S. Mitis. |
| 47 | - | + | - | + | - | S. Mitis. |
| 49 | - | + | - | + | - | S. Mitis. |
| 51 | - | + | - | + | - | S. Mitis. |
| | - | + | + | + | - | S. Faecalis. |
| 58 | - | + | - | + | - | S. Mitis. |
| 59 | - | + | + | + | - | S. Faecalis. |
| 62 | - | + | - | + | - | S. Mitis. |
| 64 | - | + | - | + | - | S. Mitis. |
| 68 | - | + | + | + | - | S. Faecalis. |

Therefore Streptococci do occur in the Vagina during the child-bearing period in cases with no evidence of infection. They are particularly common in multiparae with relaxed and deficient pelvic floors, as are also other organisms, but their virulence will be discussed later. It will be noted that all the strains isolated were non-haemolytic, except that from Case 40, where the haemolytic ring was very slight and not at all typical. Streptococcus Salivarius was found only once. S. Mitis and S. Faecalis were the predominant types. Case 51 had two strains present.

B. In pregnant patients.

Fromme[21] examined 100 Pregnant patients who subsequently had normal puerperia and in 27 of these he found streptococci which were non-haemolytic. He never found haemolytic streptococci in pregnancy. Of 36 normal puerperae, 19 had non-haemolytic streptococci and none haemolytic. Gonnet had similar results. He found 16% of his pregnant patients to have in the Vagina streptococci which were non-haemolytic. In the puerperium, however, only 10 out of 100 had streptococci: 6 were non-haemolytic and remained afebrile, the other 4 had haemolytic streptococci and showed the typical picture of Puerperal Fever. These had had no Streptococci in the Vagina during pregnancy. These authors therefore conclude that the non-haemolytic Vaginal/

Vaginal streptococcus is non-pathogenic, and that the infection comes from without.

Bumm and Sigwart[12] have isolated streptococci from 69% of pregnant patients and from 72% of patients in labour. 15% were haemolytic and yet the patients had no temperature in the puerperium.

Doderlein (4%)[15], Walthard (27%)[70], Burguburu (8%) have all isolated streptococci from the pregnant Vagina. Fricke[19] showed that the proportion of cases with streptococci in the Vagina seems to vary with the personal cleanliness of the patients. In hospital 8% of cases had streptococci in the Vagina, whereas when the same class of patient was examined at home, 55% gave positive results. Schäfer[60] examined 60 pregnant patients and found streptococci in 52, and though 4 of these were haemolytic none of the patients had more than a slight disturbance of temperature during the puerperium. He therefore concludes that these organisms from the Vagina are non-pathogenic and have no influence on the puerperium.

In all the above investigations the secretion was taken from the Vagina. The results would have been more convincing had the material been taken from the cervix, as the lower part of the Vagina is frequently contaminated from the Vulva. Williams is still sceptical as to the presence of streptococci in the pregnant Vagina, and recently Dr Charlotte Houlton[31] has published the results of the examination of the Vaginal/

Vaginal secretion of 98 pregnant patients and she grew Streptococci from only one case, though other organisms were abundant. That one case, further, had a pathological amount of discharge.

My own investigation of this question was as follows:-

Apparently normal pregnant patients, i.e. those without pathological discharges, attending the Antenatal Clinic at the Royal Maternity Hospital for the first time, were those used for the purpose of making cultures from the Vaginal secretion. The cultures were therefore taken before any Vaginal examination had been made. During the process of taking the cultures sterilised rubber gloves were worn. The patient was put in the Lithotomy position, the Vulva was carefully cleansed with a weak solution of Lysol by means of tow swabs. The Labia Minora were separated and their inner surfaces disinfected in the same way. A sterile Cusco's Bi-valve speculum was then inserted, with the right hand while the labia minora were held apart with the fingers of the left hand. The cervix was exposed beyond the speculum. An ordinary inoculating needle was then sterilised in the flame of a spirit lamp, and after it had cooled a loopful of secretion was taken from the outer surface of the cervix, and several streaks made on the surface of a serum agar plate.

This was incubated and the colonies examined after

24 or 48 hours, and the different organisms identified. Streptococci if present were isolated and classified according to Holman's method already described, and the bile-solubility test was also applied.

70 patients were examined in this way. 31 were Primiparae and 39 Multiparae. Of the 70, only 8 yielded sterile cultures. B. Coli was found in only 4 cases, all Multiparae, two of them having very marked deficiency of the perineum.

Staphylococcus Albus was found in 34 cases, and Diphtheroid Bacilli of various sizes in 35, and these organisms may be regarded as being of no importance.

Staphylococcus Aureus was found in one case only (Case 28).

The Streptococci were the most interesting organisms. These were found in 11 out of the 70 cases (i.e. in 16%). 5 of the cases were Multiparae and 6 Primiparae. Only one of the varieties of Streptococcus found was Haemolytic and that one produced very marked clear haemolytic rings round its colonies when sub-cultured on blood-agar plates.

In only 2 cases (18 and 60) were the streptococci in pure culture.

The classification of these organisms by Holman's method resulted as follows:-

| Case. | Multipara or Primipara. | Haemolysis. | Lactose | Salicin | Mannite | Inulin | Type. |
|---|---|---|---|---|---|---|---|
| 10 | M. | - | + | + | + | - | S. Faecalis. |
| 11 | P. | - | + | - | - | - | S. Salivarius. |
| 18 | P. | - | + | + | - | - | S. Mitis. |
| 26 | P. | - | + | + | - | - | S. Mitis. |
| 27 | M. | - | + | + | + | - | S. Faecalis. |
| 30 | M. | - | + | + | - | - | S. Mitis. |
| 33 | P. | - | + | - | - | - | S. Salivarius. |
| 43 | P. | - | + | - | + | - | S. Mitis. |
| 47 | M. | - | + | - | - | - | S. Salivarius. |
| 52 | M. | - | + | - | - | - | S. Salivarius. |
| 60 | P. | + | + | - | - | - | S. Anginosus. |

It was not possible to control these results by observing the character of the puerperium in these cases as the patients attending the Clinic receive as a routine a course of Streptococcal Vaccine.

## VIRULENCE OF VAGINAL STREPTOCOCCI.

There therefore seems to be little doubt that streptococci do occur in the Vagina in pregnant patients in Primiparae and Multiparae alike. The chief difficulty in this work lies in the lack of any exact method of estimating the virulence of these organisms. Haemolytic streptococci are generally supposed to be more virulent than non-haemolytic ones, but a haemolytic streptococcus may be harmless and a non-haemolytic streptococcus may cause a fatal infection. Even Schottmüller[66] admits that a haemolytic streptococcus may be present without causing ill effects. He believes that the virulent streptococci are haemolytic but while haemolysis remains constant their virulence may deteriorate. He suggests that a patient with haemolytic streptococci in the Vagina may be looked on as a healthy carrier of a potentially virulent organism. There is some inherent power in the tissues or some deterioration in the organism which makes it relatively harmless for that particular case. We know that the medium/

medium in which an organism is grown has a great influence on the preservation or rapid loss of virulence of the organism. In the same way, the secretion of the Vagina is highly acid, whereas in the puerperium it is alkaline. It is quite conceivable that this change in the character of the culture medium may develop the virulence of what is during pregnancy an apparently harmless organism. Lamers[35] declares that even the power of haemolysis is influenced by this change of reaction of the Vaginal secretion and he claims, by repeated daily examination of the lochia, to have traced this change and watched its gradual development in a series of cases. Philipp[48] shows that haemolysis is only a relative property - an organism may be so weakly haemolytic that it will haemolyse only horse blood and not human or rabbit blood, and that this power varies.

In short, such is our knowledge at the present day that we can only regard a haemolytic streptococcus as more suspicious than a non-haemolytic one, but we must not be surprised if it turns out to be perfectly harmless.

Animal experiments as a test of virulence are at best fallacious. Animals often react to infection in an entirely different way from human beings. Practically all attempts to produce lesions in animals with these Vaginal organisms have been unsuccessful.

Inoculations/

Inoculations have been tried intravenously, intra-peritoneally, intra-ocularly, and even under the mucous membrane of the mouth. Burguburu reports negative results in all cases where Vaginal streptococci were used. With large injections Döderlein managed in three cases to produce abscesses but with little surrounding reaction. Walthard, however, produced in 4 cases a spreading cellulitis leading to septicaemia in 2 cases. Kanter and Pilot[32] found a typical Streptococcus Pyogenes in the Vagina of three pregnant patients, all of whom had a normal puerperium. They injected 2 - 4 cc. of a glucose ascitic broth culture of these organisms intravenously into rabbits. The animals developed an acute arthritis but recovered.

Schäfer[60] has suggested a novel test of virulence. He tested the action of sterilised Vaginal secretion on (a) two strains of streptococci isolated from fatal septic cases; (b) a streptococcus from the normal pregnant vagina and (c) a strain from a febrile puerperal uterus. All were non-haemolytic. He found that the virulent strains were killed in 1 - 4 hours, whereas the others were still alive after 12 - 15 hours. He repeated the experiment with (a) two old laboratory strains, (b) a streptococcus from a case of acute peritonitis and (c) one from a healthy pregnant patient. The same result was obtained here, the virulent streptococcus dying in 6 hours, the others being alive after

12/

12 hours or more. This is interesting and suggests that there are streptococci which have a special resistance to the acid in the Vagina, not possessed by the more delicate pathogenic varieties. Loeser has tested this method and, by neutralising the section has found that it is the acid which has the bactericidal effect.

Ruge[53 & 54] has recently suggested a new method of estimating the virulence of an organism for the patient in whose tissues it is found. He mixes two or three platinum loopfuls of the streptococcus-containing Lochia with $\frac{1}{2}$ - $\frac{1}{3}$ cc. of defibrinated blood from the patient, and incubates. He examines a loopful at a time at intervals of an hour, comparing the numbers of organisms in the film in each case and gives the prognosis according to the rate of destruction or growth of the bacteria.

Methods of agglutination have of course been used in recent years. Sternberg[68] isolated Staphylococci or Streptococci from 20 Gynecological cases where the patient had no discharge and the organisms were therefore non-pathogenic at the moment. He tested the agglutinating power of the patient's serum against her own organisms and found that in 13 cases they were agglutinated in dilutions of 1 : 80 and over. In 4 cases agglutination occurred below 1 : 80, and in 3, not at all. Only virulent organisms have the power of producing/

producing agglutinins in a patient's blood.

Walthard and Reber[72] have done some very interesting work on these lines. They have shown that the serum of a pregnant patient with streptococci in the Vagina, agglutinates her own organisms to 1 : 1255 on an average. The serum of the same patients agglutinated pathogenic streptococci to 1 : 500. On the other hand the serum of healthy men agglutinates pathogenic streptococci to 1 : 20 only. The serum of male patients infected with pathogenic streptococci agglutinated Vaginal streptococci to 1 : 600 and their own organisms to 1 : 800. Therefore Vaginal streptococci are related to pathogenic streptococci and are able to produce agglutinins. These observations tend to confirm Natvig's[46] early experiments when he showed that animals inoculated with vaginal streptococci, living or dead, developed immunity to infection with pyogenic streptococci.

Then lastly there is the clinical test of virulence. If a patient has streptococci in the vagina in pregnancy, has a prefectly normal labour with no interference, and develops fever in the puerperium, can we blame these streptococci. Bumm[12] declares that even such cases are not necessarily arguments for autoinfection - the streptococci have come somehow from outside. He instances his own experience. His spontaneous deliveries had an average puerperal morbidity of 8%. After an undetected septic case had been delivered/

delivered in the labour ward, the morbidity of spontaneous cases rose to 16% and remained so for weeks. It did not decrease till the room had been thoroughly disinfected. Therefore in the extra 8% the infection had come in some undetected manner from without, why not in all?

Bumm and Sigwart[12] found haemolytic streptococci in 3 out of 20 pregnant women and in 3 out of 35 patients in labour and none of these had a febrile puerperium. Koch[33] examined 33 pregnant patients and found these organisms in 3, and the puerperia were normal. 10% of Lamers' cases had these organisms in the vagina and no disturbance of the puerperium. Out of 67 pregnant patients Kanter and Pilot[32] found haemolytic streptococci in 9, and only one of these had a febrile puerperium, and that was a Caesarean Section case. It is difficult to know whether this same streptococcus was the cause of the infection.

Sachs[57] has made some very interesting observations on 672 cases of labour, 78 of which were febrile during labour. These are well worth summarising as they deal partly with the pathogenicity of the organisms in the Vagina. The chief organisms to look for are, in his opinion, Haemolytic Streptococci, non-haemolytic Streptococci and Streptococcus Viridans, and Bacillus Coli. These he found both in febrile and in afebrile labours, (Haemolytic 29, non-haemolytic 139, B. Coli 20) and their influence on the puerperium was as follows.

The/

The average puerperal morbidity of the 672 cases was 25%. Of all the cases with B. Coli, whether febrile during labour or not, 50% had a morbid puerperium. 30% of the non-haemolytic streptococcal cases had a morbid puerperium (45% if the labour was febrile). The haemolytic streptococcal cases are the interesting ones; 62% of all these had a febrile puerperium - 50% of those where the labour was normal and 100% where the labour was febrile. These cases, however, are no proof of the virulence of Vaginal Streptococci as these organisms might have entered or been introduced into the Vagina after the commencement of labour.

Therefore Streptococci occur in the Vagina in normal pregnancy. Even haemolytic streptococci have been found without the patient developing fever in the puerperium. There is, further, no absolute proof that these Vaginal organisms can cause Puerperal Fever. Serological work, however, suggests that they are related to the pyogenic organisms and are potentially virulent. But it also makes the further suggestion that the patient is immunised against her own streptococci and therefore, so far as she is concerned, they are non-pathogenic. Only if general resistance is greatly lowered by bleeding, exhaustion, bruising of tissues, are they at all likely to cause infection. When sepsis does occur, therefore, it is probably due to some recently introduced virulent organism. Included among recently introduced virulent organisms, however, are those which may ascend from the Vulva.

## VAGINA AND UTERUS IN THE NORMAL PUERPERIUM.

Let us now consider briefly the bacteriology of the normal puerperium. Natvig[46] as the result of a most elaborate investigation has been able to demonstrate that even in patients who had never been examined and who were treated in special rooms by special nurses, and who did not develop a rise of temperature, streptococci could be found in the uterus itself on the 9th day of the puerperium. He isolated 22 strains of these organisms from the Vulva, Vagina and Uterus of 10 such cases. The anaerobic form he regards as quite non-pathogenic. It was present in 6 of the 10 cases, and only with repeated massive injections could he produce abscesses in mice by means of it. In patients it is never found except as part of a mixed infection. The only authentic case where it was present in pure culture was Menge's[34] where it was found in an abscess of the Parametrium.

The facultative anaerobic forms obtained from these cases were more virulent - 9 of the 16 were haemolytic, and produced abscesses in animals and Erysipelas on injection under the mucous membrane of the mouth of rabbits. One of the patients with a non-haemolytic streptococcus on the Vulva before labour, developed Puerperal Fever with haemolytic streptococci in the Vagina and the Uterus after labour. By passage through/

through mice, Natvig was able to convert the non-haemolytic organism into a haemolytic one with cultural reactions similar to those of the streptococci found in the puerperium. It does seem that these organisms can change their haemolytic properties, though not necessarily at the same time their virulence - this organism must always have been at least potentially virulent.

Wegelius[79] examined 10 normal primiparae with similar precautions, before, during and after labour, and showed that organisms of all sorts - Streptococci, Staphylococci, Diphtheroids, Sarcinae, Anaerobic spore-bearing bacilli - began to ascend from the Vulva about the 4th day of the puerperium, and by the 9th day the Uterus normally contained all the Vulvar flora except B. Coli.

In more recent years Loeser[40] examined with most scrupulous technique a series of 56 normal puerperal patients - all occipito-anterior cases with normal delivery, and no lacerations of Perineum, Vagina or Cervix, and no retention of membranes. After introducing two specula to keep the Vaginal walls apart he passed a tube 1 cm. wide into the Uterus. Through this, by means of a Pasteur pipette, he was able to remove secretion from the uterus beyond the tube. He examined 8 different cases per day during the first 7 days of the puerperium, and his results are wonderfully consistent. Half of the patients had been examined/

examined during labour and this appeared to make no difference. He found that the Vagina is always heavily infected after the first day; the Cervix begins to be infected on the first day and is always infected after the third. The Uterus may be infected as early as the second day, and is always full of organisms by the fifth day. The cases where the ascent is early often have a one-day fever. Anaerobes are the first to reach the uterus, but in the late puerperium it is always as heavily infected as the Vulva. Loeser found B. Coli in the uterus in only one normal case.

Wegelius declares that the conditions favouring early ascent of organisms are retention of a piece of placenta or membranes, tears, and subinvolution of the Uterus. None of these were present in Loeser's series.

Lamers[35] made an extensive examination of 415 pregnant patients, using as many as 50 plates for each patient, and could find haemolytic streptococci in the Vagina in only 3%, i.e. 13 cases. In the normal puerperium they are to be found in 13 - 68%. By excluding vaginal examinations, infection from other patients, from bedding, etc., and by comparing the findings from day to day, before, during and after labour, he concluded that these haemolytic streptococci are derived from the non-haemolytic organisms of pregnancy. He believes, moreover, that they are non-pathogenic and that pathogenic streptococci are always derived/

derived from outside.

Schmidt[61] examined 100 pregnant and 100 puerperal patients and found haemolytic streptococci in 7% of the former and in 68% of the latter. Sigwart's figures[12] are 15% and 68% and the organisms were present in pure culture in some of his cases in the Uterus itself after the 2nd - 4th day.

Therefore normally after the 4th or 5th day of the Puerperium the Uterus is a heavily infected cavity. Among the organisms which have been found in it in afebrile cases are haemolytic, non-haemolytic and anaerobic streptococci, Staphylococcus Albus, Diphtheroids, B. Phlegmones Emphysematosae, and the Gonococcus. Seldom is B. Coli present in normal cases.

The same facts hold in protracted cases of incomplete abortion. The uterus in these cases is never sterile.

Among my own series of Gynaecological cases were included 7 cases of abortion. One of these was complate and the culture taken from the interior of the cervix had two colonies of Diphtheroids and three of Staphylococcus Albus.

The other six were all incomplete abortions and organisms were found in abundance in all of them in the cervix and in the shreds of the ovum. All were afebrile before curettage and none of them had any febrile reaction after operation.

Four/

Four of the 6 had Streptococci inside the cervix, one haemolytic and one (non-haemolytic) in pure culture. The other organisms found were Staphylococcus Albus, Diphtheroids, B. Coli, B. Proteus, and Gram positive spore-bearers. The discharge in one case where diphtheroids alone were found, was particularly foul. The organisms were found in the shreds of ovum as well as in the cervix. Therefore it is obvious that the mere presence in the uterus of decomposing tissue is not sufficient to cause a rise of temperature. Further, in these cases even the streptococci must have been harmless either because they were completely avirulent or because the patient had developed an immunity to them. The latter suggestion was probably correct in one of the cases where the patient had been bleeding for 4 weeks. At the commencement she had had a temperature of $101^{\circ}$ - $102^{\circ}$ but this had settled in 3 - 4 days and there was no reaction after operation.

Is there any difference in the bacteriology of the Uterus in the febrile puerperium or the febrile abortion?

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## VAGINA AND UTERUS IN FEBRILE INCOMPLETE ABORTION AND FEBRILE PUERPERIUM.

In 1910, Schottmüller[65] studied the bacteriology of the uterine secretion in 100 febrile incomplete abortions. The most important organism in his estimation is the Streptococcus which he calls Putridus, i.e. it is an anaerobic organism producing foul-smelling gas in culture. He found it predominating in 29 of his cases. In only 6 did he find a haemolytic Streptococcus. In the other cases he found B. Coli, Staphylococci, B. Phlegmones Emphysematosae, Pneumococcus, Streptococcus Viridans, Gonococcus and B. Paratyphosus B. Likewise he examined the flora of 50 cases of Puerperal Fever[64]. There he found the haemolytic Streptococcus, and the anaerobic variety equally frequently - 15 cases each. The other organisms found were as above and in addition Diphtheroid Bacilli. 24 of the 50 cases had extrauterine complications however, and in all of these with two exceptions, streptococci of one or other or all varieties were found in the cervix in pure culture.

He next compared these cases with a series of 35 patients who developed slight fever in the puerperium after perfectly normal labour. The organisms found were the same in these as in the severe cases.

Warnekros[77] /

Warnekros[77] examined 80 febrile abortion cases, 10 of which were fatal and showed that even in fatal cases the offending organism was not necessarily present in pure culture. Only in 25 out of 70 non-fatal cases were streptococci present (16 haemolytic). He likewise demonstrated that the same organisms are present for several days after the contents of the uterus have been removed and the temperature has fallen.

Friedrich[20] also examined both Puerperal Fever and abortion cases and found Streptococci, Staphylococci, Gram positive bacilli and B. Coli as the chief organisms. They were present in mixed culture even in fatal cases. He regards B. Coli as very important and found it in a very large proportion of his 27 cases (44%). It was present in the pus of secondary abscesses and even in the blood in some cases so that this could not have been a vulvar contamination at the time of taking the culture.

Heberer[27] examined the lochia of 44 patients, cases of febrile uncomplicated incomplete abortion, and found organisms in pure culture in 17, and in mixed culture in 27. Streptococci were present in only 24 out of the 44, 8 times in pure culture, 7 being haemolytic. The other organisms found in pure culture in these febrile cases were Staphylococci, B. Coli, Gram-negative bacilli, Gram-positive diplococci.

Fromme[21] examined 14 febrile puerperal patients and found haemolytic streptococci in the uterus in all

of them on the first or second day. Haemolysis disappeared on subculturing. Fromme believes that the ability to separate the streptococci is an indication of endometritis. He compares these 14 with 29 cases which he calls "sapraemic". From these he could separate streptococci in only 2 and these were non-haemolytic. In the remaining 27 he could grow only saprophytes.

Werner and Zebrzycki[80] examined 200 febrile puerperae and their results were as follows. They obtained Streptococci of various kinds in 182 of their cases 102 times in pure culture, 118 haemolytic. Their non-streptococcal cases contained B. Coli, Staphylococci and Gonococci, sometimes in pure culture, sometimes mixed. There were 6 fatal cases, all with streptococci in the lochia, and 5 of them with streptococci in pure culture.

From the examination of 74 febrile abortions, Offermann[47] found that 7 out of 50 with no extrauterine complications had streptococci in the lochia, and 13 out of 24 complicated cases yielded these organisms. 3 out of his 6 fatal cases had Streptococci.

From these observations it may be concluded:-

(1) That the same kinds of organisms occur in the puerperal uterus in febrile as in afebrile cases.

(2) That streptococci are more frequently present than any other individual organism in febrile incomplete/

incomplete abortions and in true puerperal fever, but especially so in the latter.

(3) That they are more frequently present in pure culture, especially in complicated cases, than are other organisms.

(4) That other organisms may be present in pure culture even in fatal cases. B. Coli is very important here.

(5) That fatal cases occur where nothing but an abundant growth of saprophytes is to be got from the Uterus.

(6) That none of the organisms found in Puerperal Fever or in febrile incomplete abortion can be distinguished morphologically or culturally from those found in the normal puerperium.

(7) That examination of the lochia does not therefore give us much information as to the aetiology of the condition. Though a Streptococcus is present, it is not necessarily in all cases a serious infective agent, and though no streptococcus is isolated, yet this does not exclude a serious infection with that organism. X

Whether or not a patient with streptococci and other organisms in the lochia is going to develop fever must depend on the virulence of the organisms and on the resistance of the patient's tissues, because bacteriologically similar cases may be totally different/

different clinically. That cases with a retained piece of placenta or ovum can remain afebrile though the uterus is filled with organisms and the lochia are foetid, and that cases become febrile though no decaying tissue is present in the uterus, shows that the placenta itself cannot be the determining factor, though it may have some influence on the clinical course of the disease. This will be discussed later.

The old subdivision into sapraemic and septic cases is very loosely used nowadays. The sapraemic case was supposed to be one where the organisms were living entirely in the dead tissues in the uterus - placenta, ovum, blood clot, and tags of dead endometrium. The toxic products of their growth were absorbed and the patient reacted with a rise of temperature. The test of a sapraemic case according to Bumm is to clear out the uterus. If the temperature falls at once the case is a sapraemic one. The septic cases were those where virulent organisms were present, actually invaded the patient's tissues and caused anything from an endometritis to a septicaemia. If drainage is satisfactory, it is questionable whether the former condition ever occurs, because, for example, abortion cases with obvious foul-smelling discharge and putrefaction of the uterine contents need not have a rise of temperature.

If,/

If, however, there is some obstruction to the outlet, caused perhaps by a half-protruding ovum, or by retroflexion of the uterus, the tension inside the cavity rises, a condition similar to an unopened abscess results, and a certain amount of toxic absorption is made possible. As soon as this is remedied the temperature falls. Conversely when the temperature does fall after clearing out the uterus, the fever has probably been due to bad drainage.

## BLOOD EXAMINATION IN INCOMPLETE FEBRILE ABORTION.

Schottmüller in 1910[65] by examining the blood in febrile incomplete abortion cases threw additional light on the pathology of this type of case. All his cases were operated on immediately after admission to hospital. He took blood cultures before and after operation with the result that in many out of his series of 100 febrile cases, he found organisms present in the blood on both of these occasions. The organisms found by him were Anaerobic Streptococci, B. Coli, B. Paratyphosus B., Anaerobic Staphylococci, Staphylococcus Aureus, Pneumococcus, B. Phlegmones Emphysematosae, i.e. any of the organisms which one might expect to find in the uterus under these circumstances can reach/

reach the blood stream. He therefore concluded that the Uterus is an infected cavity, containing organisms of many descriptions living in the lochia, the remains of the ovum, the placenta etc. As the uterus contracts and relaxes, the organisms are able to reach the open veins at the placental site, and as they enter the blood stream the patient reacts with a rigor. The blood soon destroys them and the temperature falls, but rises again at the next invasion. The best time for finding organisms in the blood is therefore during a rigor, and the rigor which often follows operative interference is to be explained in the same way. Not all of his cases had positive blood cultures and several of the severe cases, e.g. that with the Pneumococcus in the blood, were fatal, but in many instances there was a definite blood invasion of a transient type. Schottmüller concluded from these observations that the organisms mentioned are all potentially pathogenic because they can reach the blood stream, but it is not necessary to assume this. As is to be expected from the mechanism of these cases and from the condition of the uterus at the time, several different kinds of organisms may be found simultaneously in the blood. One case which he reports had Staphylococcus Aureus, Pneumococcus, and B. Emphysematosus in the blood stream together.

Schottmüller further believes that the rigor which follows/

follows curettage of an abortion is due to an invasion of the blood stream which is no more severe or dangerous than any single invasion which occurs while the uterus is contracting. The presence of a bacteraemia while there is still something in the uterus, he regards as of little prognostic significance even when haemolytic Streptococci are found. But as repeated reinfection of the blood stream lowers resistance he holds that in all these febrile uncomplicated cases the uterus should be emptied at once. In these cases the numbers of organisms entering the circulation are relatively large, and they are therefore easily detected on culture.

Since that time several observers have tried to confirm Schottmüller's findings. In 1912 Warnekros[77] examined the blood and lochia before and after operation of 80 cases, 70 being uncomplicated by extra-uterine lesions. 61 of the 70 cases had positive blood cultures before operation and if a rigor followed the operation organisms were again found in the blood. All were negative 24 hours after the curettage and all recovered. The organisms found were Streptococci (aerobic and anaerobic), Staphylococci, B. Coli, B. Phlegmones Emphysematosae and unidentified bacilli. Most of these cultures (52 cases) yielded a mixture of organisms as might be expected. Only 20 cases had Streptococci and 9 of these were haemolytic. Only 2 had Streptococci in pure culture, 3 had B. Coli alone.

Out/

Out of 10 complicated cases which were all fatal, 9 had positive cultures in the blood. 5 were pure septicaemias with continuously positive blood cultures, quite irrespective of operation, four being streptococcal and the other due to an unidentified Gram-negative bacillus. Another had Peritonitis due to a Staphylococcus and that organism appeared in the blood. But in the other 3 positive cases, organisms like B. Coli, B. Emphysematosus, Diphtheroids, and anaerobic Streptococci were grown from the blood. One patient died of a peritonitis caused by an aerobic streptococcus, but in the blood only obligate anaerobic streptococci and B. Emphysematosus could be found. Another died of a mixed Streptococcal and B. Coli infection of the peritoneum, but in the blood in addition to these organisms Diphtheroids and B. Emphysematosus appeared before operation. Warnekros therefore concludes that the culture taken 24 hours after curettage is the important one from the prognostic point of view. If an organism is found then, it is living in the blood or is coming from a focus outside the uterus. Before the Uterus is emptied, though organisms reach the blood stream they are not necessarily the cause of the illness. Any of the uterine organisms are liable to enter the blood stream along with or independently of the true infective agent, hence it is not necessary

to/

to assume with Schottmüller that these saprophytes can cause true Puerperal Fever.

In 1921, Heberer[27] reported the results of examination of the blood of 40 cases of febrile incomplete abortion, before operation. Only 7 were sterile, 24 gave a pure culture and 9 mixed. Of the 24, 14 had streptococci - 8 haemolytic, 2 non-haemolytic, and 4 anaerobic. The other organisms found were B. Coli, Diplococci, Staphylococci and thick Gram-negative Bacilli. The organisms in the blood corresponded in the majority of cases with those in the uterine cavity. In only 2 of the non-fatal cases were organisms present in the blood 24 hours after operation. In all his 6 fatal cases, organisms were recovered from the blood.

Fromme's results[22] are likewise in agreement with these. He reports 34 cases of incomplete abortion where organisms were found in the blood. 12 were fatal. In both the fatal and non-fatal cases the organisms found were the same as those reported by other observers, and in only one of the fatal cases was the organism in the blood a haemolytic streptococcus. Fromme concludes that that organism does not play such an important part in incomplete abortion cases as in true Puerperal Fever and that its presence in the blood before the uterus is empty, means no more than that of any other organism. After the uterus is empty the blood examination is of the greatest importance.

We/

We have therefore sufficient evidence collected from reliable observers to show that in incomplete abortions before the uterus is emptied, organisms do very frequently reach the blood during contractions. They are rapidly destroyed in the blood-stream. This blood invasion therefore is the second cause of rise of temperature in incomplete abortion cases where the uterus is contracting, the first being bad drainage. The rise of temperature in these cases is usually a sharp one accompanied by a rigor. Emptying the uterus in these cases likewise would not necessarily do harm, provided that there was no additional infection by virulent organisms.

The third cause of rise of temperature in incomplete abortion cases is true infection of the uterus with virulent organisms. This may be present in addition to defective drainage or blood invasion by saprophytes, and these are the cases where operation does no good, the temperature remains high and the organisms continue to spread after the uterus is emptied.

Therefore the first stage at which a bacteraemia may be found is before the uterus is emptied naturally or artificially in cases of incomplete febrile abortion. At this stage as has been pointed out, any organism which is to be found in the puerperal uterus is liable to enter the blood stream. In proportion to other

organisms the Streptococcus does not occur more frequently in the blood than it does in the normal puerperal uterus. Only 30 - 40% of positive blood cultures at this stage contain streptococci. This points to the conclusion that it is a mechanical process and is relatively harmless in most of these cases. Although the bacteraemia which occurs at this stage is interesting from the point of view of pathology, the prognosis cannot be established from the blood findings at this time.

BLOOD EXAMINATION AFTER OPERATIVE INTERFERENCE.

The second stage at which a bacteraemia may be looked for is during the rigor which often follows normal or artificial delivery of such febrile and sometimes of afebrile cases. When this occurs, it is, like the above, frequently a temporary affair.

By examining the blood immediately after operative interference in febrile abortion cases, Sachs [55 & 56] has shown that for 5 - 10 minutes after operation all sorts of organisms are present in large numbers - even streptococci. These disappear more or less completely in half-an-hour and are gone by the next day. This type of invasion is easily withstood and prognostically has no significance.

In/

In 1908 Fromme[21] had three such cases - where a transient bacteraemia occurred after operation. In one case he found the Staphylococcus Aureus in the blood, and in the other two, B. Coli.

Friedrich[20] had a similar case in his series - case 14 - where before operation the blood was sterile and operation was followed by a temporary flooding of the circulation with B. Coli.

Benthin[4] has one case where Diplococci, Bacilli and anaerobic Streptococci appeared in the blood immediately after the uterus was emptied, and were still present 20 minutes later. After 24 hours only 2 colonies of bacilli remained. Later the blood was sterile and remained so.

There is also plenty of evidence of a bacteraemia of a more serious nature, resulting from operation on these infected cases.

In 1911, Schottmüller[63] had, out of 70 cases with haemolytic streptococci in the lochia, 6 cases uncomplicated on admission, which after operation developed a bacteraemia and took weeks to recover. Traugott[69] had similar cases:- a patient with normal temperature had the uterus emptied digitally, next day the temperature rose and on the 5th day haemolytic streptococci appeared in the blood. The patient died on the 10th day. Another, admitted with temperature and a negative blood culture and non-haemolytic streptococci/

streptococci in the lochia was curetted; on the 2nd day the same streptococci appeared in the blood and the patient died of a purely blood-spread infection on the 6th day after operation. Traugott estimates that 24% of the patients admitted to hospital in an afebrile condition with haemolytic streptococci in the lochia, have Puerperal Fever after the uterus is emptied.

Benthin[4] has reported a case accurately observed where the blood was sterile and the temperature normal. A retained piece of placenta was removed from the Uterus and immediately after this the blood contained haemolytic streptococci and bacilli. 20 minutes later these had almost disappeared. Next day no organisms were to be detected, but the following day, the Streptococci reappeared and the patient had a pyaemia lasting for 3 weeks. Other two cases had haemolytic streptococci in the blood after operation though not before. Both recovered after a long illness. He also reported one fatal case where streptococci appeared for the first time in the blood during the rigor following curettage. Parametritis developed and ultimately the patient died of a metastatic empyaema.

Halban and Köhler[25] had a similar case of incomplete abortion, admitted with normal temperature and pulse 84. The uterus was emptied. A rigor followed. B. Coli entered the blood-stream and could be detected on culture. Simultaneously the infection spread through the Tubes to the Peritoneum and the patient died.

Felty/

Felty and Keefer[16], discussing the part played by B. Coli in sepsis, reported 6 cases of blood infection by this organism where the primary focus was in the female Genital tract. In 5 of the 6 the blood invasion occurred after operative interference (not specified) and 3 of these were fatal.

These cases all show that where virulent or potentially virulent organisms are present in the uterus or in the inflamed endometrium, any mechanical interference is liable to hasten their spread and to inoculate them directly into the blood-stream. And as we have already seen, except where the fever is due solely to insufficient drainage or to periodic absorption of bacteria into the circulation by the contracting uterus, it is probable that febrile cases have some really pathogenic organism in the uterus. In the first 2 sets of cases, interference will do no harm, in the last, by disturbing the protective leucocyte layer in the uterine wall it will cause a direct spread more deeply into the tissues or may even inoculate the organisms directly into the veins and cause a fatal blood infection.

The first two stages where bacteraemia is to be found are therefore those where sudden massive invasion of the blood stream takes place from the interior of the uterus and the patient reacts usually with a rigor. They occur (1) during an incomplete febrile abortion and/

and (2) after curettage of such cases. The organisms are usually rapidly overcome, except in some cases in group 2 where the infecting agent is a virulent one, and operation assists it to spread.

## BLOOD EXAMINATION IN THE FEBRILE PUERPERIUM.

The third and most important time for finding organisms in the blood is during the puerperium itself, whether after abortion or after full-time labour.

If organisms are then present they must either be living and multiplying in the blood stream (i.e. the patient has a septicaemia) or they must be repeatedly derived from some source in connection with the blood stream. There are two chief sources of this sort in the puerperium - the pelvic veins, including the veins of the uterine wall, and the heart valves. The uterine cavity itself is no longer in direct communication with the circulation after the first few hours - it is separated from the blood stream by blood clots and if it is at rest, and if there is no interference organisms can reach the circulation only through these clots or the uterine muscle, and by causing a secondary phlebitis. There is therefore a chance of the infection quieting down before this happens. Bacteraemia therefore does not occur in the absence of interference, without some complication in the uterine/

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uterine wall or beyond it.

During the febrile puerperium organisms are very difficult to find in the blood. Many cultures are negative - it may be because the blood is actually sterile or because even in septicaemic cases only a few organisms are circulating, and these possibly in a devitalised condition.

In 1908 Fromme[21] examined 14 puerperal cases with high temperatures and streptococci in the lochia, and in none of these did he find organisms in the blood. The condition cleared up. He concluded that an Endometritis was present and advised that daily blood cultures should be done to recognise the stage when organisms for the first time reached the circulation. He also gives an account of 10 cases where haemolytic Streptococci were present in the blood and 9 of the patients died; 5 of them had Peritonitis in addition to the blood infection. Only 3 of the 10 had a blood infection alone - these had Streptococci in the blood and in the Lochia and were cases of Streptococcal Endometritis which had advanced a stage further and become Septicaemic. Fromme believes that there is in addition to these a large series of milder cases of so-called Lochiometra, where organisms never appear in the blood <u>without mechanical interference</u>. He examined more than 100 of these with negative results from the blood.

Halban/

Halban and Köhler's series of 163 cases is very instructive as the post-mortem results and the clinical history are given in detail in every case. Altogether repeated blood cultures were taken from 103 of these patients during life. (The 60 which were not examined were those which were too rapidly fatal, and a large proportion of those with peritoneal and tubal involvement.) Of the 103 cases, 17 were sterile though repeated cultures were taken. In 81 Streptococci were found - 56 haemolytic, 24 non-haemolytic, and one anaerobic. Staphylococcus Aureus was found in 3 cases, all with vein involvement. B. Coli was present in the remaining case - one where the spread was by Lymphatics and Tubes combined, and where Peritonitis was present at death.

It is interesting to note that out of the 55 cases from which blood cultures were taken in the presence of actual involvement of the veins, with septic breaking-down clots, 8 remained sterile repeatedly, even when the blood was taken during rigors. In one noteworthy case (Case 2) where there was an infected thrombus in the Vena Cava itself, repeated blood cultures remained sterile. The other 7 negative cases all had infection of the large veins and many of these had metastatic abscesses in the lungs, showing that organisms must have traversed the blood stream though they were never recovered from it.

Incidentally it may be mentioned that this is a complete/

complete contrast to the experience of Warnekros who has reported from time to time [73, 74, 75, 76] several cases of puerperal pyaemia carefully controlled by blood cultures, taken chiefly with a view to determining the most suitable time for operation by ligature of the infected veins. He declares that if the blood is taken during or immediately after a rigor in these cases it is always possible to recover organisms from it. Between rigors the blood is usually sterile in the more favourable cases, i.e. the blood is able to destroy them by its bactericidal power. His cases at operation, however, were found to be instances of pure thrombophlebitis without even any periphlebitis. Such cases are very few - from his wide experience he has quoted only six, and in Halban and Köhler's series only 3 out of 163 were of this type. When Periphlebitis, Pelvic Cellulitis, Salpingitis and Peritonitis are also present it is not to be expected that the blood findings will correspond so accurately with the temperature.

The organisms responsible in Warnekros' cases were usually Streptococci but in one case he found Gram-negative and Gram-positive bacilli in addition. Warnekros believes that he can judge the prognosis of these cases from the numbers of organisms present in successive cultures, - if the colonies increase in number and if they grow more quickly, i.e. if the colonies appear in solid medium sooner, then the prognosis is unfavourable. Warnekros worked with Bumm who/

who held the same opinion as to the value of blood cultures in this type of cases. The acute cases with organisms in the blood between as well as during rigors he regarded as very unfavourable and quite unsuited for operation. Sigwart also regards blood cultures as very valuable in these cases - the stages of the illness can be traced out by means of them - first endometritis, then a bacteraemia lasting for a day or two, and then settling down into a thrombophlebitis with Pyaemia.

Other observers would like to be able to rely as certainly on the examination of the blood. Werner and Zebrzycki[80] in 1914 examined 200 cases of Puerperal Fever. They took blood cultures from 61 of the worst of these, and obtained positive results in 9 only. The organisms found were haemolytic Streptococci in 8 cases and an anaerobic Streptococcus in the other. 3 of the 9 were fatal. In 3 other fatal cases negative cultures were obtained every time from the blood. These observers conclude that the finding of organisms in the blood is of less value for prognosis than the clinical appearance of the patient.

Friedrich[20] does not place much reliance on blood cultures. In his series of 27 cases he had 5 severe puerperal cases with streptococci in the lochia but nothing could be grown from the blood. In 4 other cases (one of which was fatal) he did obtain organisms from/

from the blood during life. One of these was merely a temporary invasion of the blood stream by B. Coli as already described, immediately after an abortion was cleared out. Of the other three, the fatal one had a Streptococcal infection, another had a Staphylococcus Aureus pyaemia from a Mastitis and the last was a B. Coli infection following operative interference and lasting only a few days. In other two fatal cases he obtained Streptococci from the heart-blood post-mortem.

In the rest of his cases the blood was constantly sterile. He therefore concludes that cases can recover though organisms have appeared in the blood, severe and even fatal cases can have negative findings, but in the slighter cases, blood cultures are always negative.

Lamers[36] examined 25 so-called Sapraemic puerperal patients and even though the blood was taken when the temperature was highest it was always sterile. He had along with these 4 "septic" puerperals, three of whom had haemolytic Streptococci in the blood, and two of whom died. He examined the blood of 7 fatal post-abortion cases of sepsis and found organisms during life in 5 and in the heart-blood post-mortem in another. The organisms found were B. Coli 2, Anaerobic Streptococci 1, Staphylococcus Aureus 1, Bacilli and Cocci 1, and from the heart-blood of the fatal case an Anaerobic Streptococcus was recovered. Therefore the proportion of positive results compared with the number of true puerperal/

puerperal cases with temperatures, is very small, especially when the fatal cases are excluded.

In only 13 out of 50 severe febrile cases after full time labour could Schottmüller[64] find organisms in the blood, and 8 of these 13 were fatal. Two of the non-fatal cases had (1) B. Coli. (2) B. Phlegmones Emphysematosae. The others all had Streptococci. Likewise 12 out of 70 post-abortion cases with haemolytic streptococci in the lochia had a bacteraemia. Not all of them were streptococcal and not all the streptococcal cases were fatal.

Brodhead[8] has given a short account of his experience with blood cultures in these cases. He took cultures from the blood in 17 very severe cases, 11 of which were fatal. Of the 17, 10 were positive, 7 of the 10 patients died and 3 recovered. Therefore there were 4 fatal cases out of 11 in which there was no detectable blood invasion.

My own experience with blood cultures taken during the puerperium has been very much the same. I have now had the privilege of examining 62 cases.

TECHNIQUE.

The technique used was as follows:- An all-glass, three piece, 10 cc. syringe was taken to pieces and placed along with needles in a large wide test-tube, and a cotton-wool plug inserted. The whole was wrapped/

wrapped in paper and sterilised in an autoclave. It could thus be carried to the bedside in a dry sterile condition.

When required the contents of the tube were removed and the parts of the syringe fitted together, all the manipulations being done with a pair of forceps, the tips of which had been heated to dull red heat in the flame of a spirit lamp.

The patient's Median Basilic Vein was made prominent by applying a piece of rubber tubing above the elbow. The skin over it was sterilised by applying first Ether and then Tincture of Iodine and allowing it to dry. About 10 cc. of blood was removed in the usual way, and with it three flasks each containing 70 cc. of medium were immediately inoculated. 5 cc. was put into the first, 3 cc. into the second and 2 cc. into the third. For each of the first eight cases only one flask of medium was used, but thereafter three flasks were found to be more satisfactory.

The medium used was meat extract broth, with a P.H. of 7.6. Glucose broth was also tried, and also Trypsinised Broth, prepared according to the recipe in Muir and Ritchie's Manual of Bacteriology, p.43. The last-mentioned medium was found to be particularly good and the organism grew more rapidly in it than in the other media. It never happened, however, that a growth was obtained in it when none was present in the other media.

The/

The flasks were examined daily and as soon as organisms were visible sub-cultures were made on Serum Agar plates. If no organisms were visible at the end of three days the plating was done on the 4th day. It was always found that if organisms were present in one flask of medium they were present in all three.

When pus was examined from an abscess in these cases it was taken with a sterile Pasteur pipette from as deep in as possible.

If organisms resembling streptococci were found, the Bile Solubility test was done to exclude the possibility of their being Pneumococci. A 10% solution of Sodium Taurocholate was made in Normal Saline and autoclaved. One-tenth volume of this solution was added to a broth culture of the organisms. If the organisms were still visible in the culture after standing for 24 hours, they were true streptococci.

Their power of haemolysis was tested by growing them on blood agar. A clear halo round each colony was a positive result. To confirm this the liquid method was used - a serum broth culture was incubated for 16 hours. 1 cc. of the supernatant fluid was pipetted off. To this was added .2 cc. of sterile washed rabbit red blood corpuscles, and 3.8 cc. of saline. A control was put up with saline and corpuscles alone. These were incubated for 2 hours and allowed to stand over night in the ice-chest. A clear red colour in the supernatant/

supernatant fluid with disappearance of the red corpuscles was a positive result.

Streptococci were classified according to Holman's classification by means of their power of fermentation of carbohydrates.

When virulence for animals was tested, a 24 hours growth of the streptococci on several blood agar slopes was taken. The colonies were washed off with about 2 - 3 cc. of sterile saline and this emulsion was injected into the ear vein of a rabbit or into the peritoneal cavity of a mouse with a sterile record syringe. If the animal died a post-mortem examination was made. The heart was seared, and blood was removed from it with a sterile Pasteur pipette. Several tubes of broth were inoculated with this, and the cultures subsequently examined for Streptococci. If Streptococci were found they were again classified by Holman's method.

A list of cases with a brief account of the clinical history and the blood findings in each case is given in the Appendix.

62 cases were examined altogether. 41, (63%) were Primiparae. In 30 cases, (48%)' delivery was instrumental or was accomplished after some form of manipulation, e.g. Internal Version.

10 of the cases (Nos. 5, 6, 19, 23, 26, 49, 55, 57, 59 and 61) were fatal. 50% of these fatal cases were/

were Primiparae.

Out of the whole 62 cases, only 9 gave positive blood cultures, i.e. 14.5% and of these 9, five were fatal. There were other 6 fatal cases where blood cultures were negative, i.e. where death must not have been due to septicaemia but to spread of the infection by some other route. Or if the organisms were present in the blood-stream they were too much devitalised to survive artificial cultivation.

17 of the cases were slight ones. They had either a fairly high temperature for a few days, with no obvious extrauterine complications or else they ran a slight temperature for a longer time. They were never severely ill and blood cultures on each occasion were negative. The lochia were not markedly altered. Typical cases of this sort are 3, 15, 42.

Other 30 cases were more severe. The patients had high temperatures for a week or more, and were apparently severely ill. In most of these there was no obvious extrauterine focus of infection, but Case 53 had a pelvic cellulitis, Case 34 had a pneumonic patch in one lung whether metastatic or not, one cannot say, and Case 4 had a labial abscess late in the condition.

In none of these 30 patients were organisms found in the blood. Typical cases are 4, 22, 30, 38. We must therefore regard these as cases of local infection/

infection but without demonstrable invasion of the blood stream. The condition of the lochia was not uniform, sometimes profuse and foetid, sometimes scanty and sometimes unaltered.

Five other severe cases (9, 17, 29, 48 and 60) did have blood stream invasion. 9 and 60 were less serious cases than the other three, and were characterised by a short severe illness, with rigors, high temperature lasting a few days and terminating by lysis. These cases were both infections by the Bacillus Coli, and there was in neither case any obvious extrauterine focus. In Case 60 there was a definite secondary pyelitis.

The other three cases belonging to this group were streptococcal; the organisms from 17 and 29 were non-haemolytic and from 48, haemolytic. In 17 and 29 there were obvious extrauterine foci in the form of thrombosed veins and in addition there were metastatic lesions in the skin, subcutaneous tissue and round the joints. No 48 also had metastases in the subctuaneous tissue and in the throat, though there was no clinically demonstrable extrauterine focus from which these might have come. It was therefore a case of septicaemia. As the uterus was inverted, access to the circulation must have been easier than usual.

There were 10 fatal cases and in only four of these could an invasion of the blood stream be demonstrated.

3 were streptococcal (2 haemolytic and one non-haemolytic) and one was due to Bacillus Coli. The last mentioned case was again characterised by rigors. These may have been due to a flooding of the circulation with organisms, but it was only towards the end of the illness that they were constantly present in the blood. That the infection had actually spread to foci beyond the uterus was shown by the development of double "whiteleg". From these thrombosed veins the repeated blood infection probably took place.

Case 44 clinically seemed to be a similar case, but the patient's resistance was better and she was able to cope with the infection. Unfortunately it was never possible to get her blood during a rigor, and between and a few hours after rigors it was repeatedly sterile.

In Case 60 the infection was obviously related to the opening of the small perianal abscess, which was not more than a large boil. The rise of temperature did not occur till 12 days after delivery, and 6 days after the abscess had been opened, i.e. when there had been time for the organisms to ascend to the uterus and infect it. That the abscess was not itself the cause of the septicaemia was shown by its prompt healing. It had practically healed before the temperature rose.

The lochia are not always helpful in the diagnosis of serious cases, e.g. Case 61, where the infection was fatal/

fatal and the lochia were putrid.

It may therefore be concluded that positive blood cultures are more seldom got in the puerperium than in febrile incomplete abortion cases. The same massive invasion of the blood-stream from the interior of the uterus, where the organisms are easily detected does not occur after delivery is over unless there is interference.

If organisms appear in the blood spontaneously during the puerperium they are pathogenic and the case is a serious one. The organisms have reached the blood stream not from the interior of the uterus directly but by actual infection of its walls and secondary invasion of the veins. This may lead to a phlebitis and thrombosis, e.g. Cases 55 and 29, or it may result in a pure septicaemia, e.g. Case 48. The patient is about to have a serious if not fatal illness.

Organisms may appear in the blood as a result of operative interference, e.g. Case 17, where the patient was already infected but judging by the temperature seemed to be dealing successfully with the organisms. The manipulations necessary in order to remove the membranes disturbed the inflamed parts and gave a fresh impetus to the infecting organisms with the result that the patient had a serious struggle to overcome them.

Bacillus/

Bacillus Coli appears to be a more important factor in causing Puerperal Fever than is usually thought. 3 of my cases had this organism in the blood stream and one was fatal. The bacillus is a true infective agent in these cases as in Pyelitis, and causes a septicaemia but less frequently forms metastases than other organisms. Recovery is prompt in mild cases. These observations are supported by Felty and Keefer[16] who have reported 6 cases of B. Coli blood infection, originating from the female genital tract. They point out that where metastases do occur they are most frequent in the Kidney. The clinical course of one of the cases which they report is almost identical with that of Case 60.

A peculiarity common to the types of B. Coli found in all 3 of my cases, was their feeble power of fermenting lactose.

Halban and Köhler had one fatal case due to B. Coli infection. The organism spread to the blood stream and at the same time to the Peritoneum through the tubes.

Marquis[42] includes in his series of cases, one pure B. Coli blood infection, one due to a mixture of Streptococci and B. Coli and one (a fatal one) due to Staphylococci and B. Coli.

Widal and Lemierre[81] have described a fatal case of B. Coli Septicaemia where that organism was found in/

in the Uterus, Blood, and Cerebrospinal Fluid.

Friedrich[20] has two very transient post-operative cases of B. Coli bacteraemia but he has shown that this organism is frequently a true infective agent by isolating it in pure culture from the pus of e.g. abscesses in the Parametrium.

Lamers[36] had 3 fatal cases due to B. Coli infection after abortion, two of them with blood invasion.

Cases can recover, however, though Streptococci invade the blood stream. In my series there were 3 fatal and 3 non-fatal streptococcal cases, though in those which recovered the illness was a long one.

Lenhartz[38] believed that few patients recovered if streptococci were found in the blood. He had 20 positive blood cultures in his series of 60 fatal cases. Compared with this he had only 5 positives which recovered.

Brodhead had only 3 recoveries out of 10 cases with Streptococcal bacteraemia in the puerperium. Polak, however, has reported 28 cases with streptococci in the blood, and only 6 of them died. Williams[83] had 4 cases of Puerperal Fever following abortion where haemolytic streptococci were present in the blood. They all recovered under treatment with serum, and the organisms had disappeared from the blood stream in 2 - 3 weeks.

Miller/

Miller and Chalfant[43] treated 11 cases with Arsenobenzol in 6 mg. doses. 7 of these were Streptococcal cases and 5 of these recovered. 2 were due to a Gram-negative bacillus (not classified) and these also recovered.

Schäfer[59] had 7 cases of Streptococcal endometritis with blood infection, which all recovered when treated by subcutaneous injections of 50 cc. of Serum and .05 mg. of Methylene Blue daily in Saline. The illness was always a long one, and in one case the patient was in hospital for 10 weeks. Her blood was sterile after the 19th day but she had a septic thrombosis of her right Femoral Vein. The same observer had also 6 cases of Streptococcal infection treated in the same way and all of them were fatal. Post-mortem the large veins were found to be filled with necrotic purulent thrombi, showing that when the infection has got this length there is little hope of recovery. He classifies these cases separately as septicopyaemia but they are really only an advanced stage of the first group.

Of Werner and Zebrzycki's 9 cases[80], 6 recovered - 2 of them with haemolytic streptococci recovered in 7 - 9 days. Likewise Fromme[21] has in his series one case where 90 - 130 colonies of streptococci were repeatedly present per cc. of blood, but the temperature became normal after 6 days under the influence of Antistreptococcal Serum. There was no lesion recognisable/

recognisable outside the uterus.

Benthin[4] reports 8 cases of Streptococcal blood infection all of which recovered. 4 of these were incomplete abortions with the organisms in the blood before the ovum was expelled. Three of them recovered promptly when the Uterus was emptied, and one became afebrile before the ovum was expelled. That the organisms were not very virulent in these cases was shown by the fact that in two of the cases (30 and 34) organisms could be cultivated from the blood, for 3 - 5 days after the temperature had become normal. 4 of his cases were blood infections in the puerperium and these were much more serious. 3 were cases of pyaemia with metastases. Case 33 had organisms in the blood for only two days though the temperature continued to be irregular for some time. There was a distinct inflammatory mass to the right of the uterus - probably containing infected veins.

These cases show the contrast between Streptococcal blood invasion before and after the uterus has discharged its contents. The former is often transient because the organisms are not necessarily virulent, the latter is always serious and usually means that there is a real infection of the uterine wall, which has reached the veins.

## INFECTION DUE TO ORGANISMS OTHER THAN STREPTOCOCCI OR B. COLI.

In the puerperium other organisms than Streptococci and B. Coli have occasionally been found in the blood and these cases are the most frequently fatal. This is again a contrast to the findings in incomplete abortions where it is the rule rather than the exception to find other organisms, and where the bacteraemia is of less consequence. This all points to the fact that in the puerperium we are dealing with a true infection.

Fromme reports 2 such fatal cases. One was a fulminant one due to Staphylococcus Aureus and in the other the organism found was B. Friedländer and later along with it the Staphylococcus Pyogenes Aureus.

Among Halban and Kohler's cases there are 3 fatal ones due to Staphylococcus Aureus. These all had vein involvement with metastases.

Beck[3] reports an unusual case of Staphylococcus Albus septicaemia. Cultures were repeatedly taken from the blood, and this organism was always found. It was also present in the Urine, and in the Sputum, and post-mortem in the lung abscesses and in the heart-blood, so that there seems to be little doubt that that organism was the actual cause of the infection.

One/

One of Warnekros' fatal pyaemia cases[73] had a mixed infection with Anaerobic Streptococci and Gram-positive and -negative bacilli. Serum treatment caused the Streptococci to disappear from the blood, but the bacilli remained, and were present even after ligation of the infected veins. Post-mortem an abscess of the parametrium was found, containing Streptococci in pure culture, while the blood from the Vena Cava contained only the bacilli.

Schäfer[59] has described a typical fatal case of pyaemia with purulent thrombosis of the Femoral Vein, due to a mixed infection of anaerobic bacilli and staphylococci. He has also a similar case in the same series where the infection was due to a combination of Streptococci and bacilli. He does not describe the organisms further. This also was fatal.

Marquis[42] has published a series of cases where the organisms in the blood were other than Streptococci. The B. Coli cases have already been mentioned. He had two where the organisms grown from the blood were Staphylococcus Aureus and one where Staphylococcus Albus was found. These were not fatal.

Lamers[34] had one fatal Staphylococcus Aureus infection and one due to a mixture of Streptococci and Bacilli (not classified).

Foulerton and Bonney reported a fatal case of Pneumococcal "septicaemia" in the puerperium[17] without lung/

lung changes. This suggests that the infection originated in the Uterus. The organism was not isolated from the blood during life but was grown from the peritoneal pus and from the lochia.

Of Heberer's 8 fatal cases[21], 2 had Staphylococcus Aureus in the blood during life.

CASES WHERE THE INFECTION OF THE GENITAL TRACT IS SECONDARY TO A BACTERAEMIA ORIGINATING IN SOME OTHER FOCUS.

In all the cases above described the infection has originated in the Genital tract, but there are cases on record where an acute infection has taken place at a different site, organisms have reached the blood stream, and caused abortion or premature labour. The organisms then settled secondarily in the genital tract and caused what appeared to be an ordinary Puerperal Infection.

Fromme[21] had two cases of Erysipelas with organisms in the blood stream. The intensity of the infection caused premature labour and both patients died of puerperal sepsis.

Schmidt[61] had two cases where the pathologist expressed the opinion that the infection of the genital tract was not a primary but a secondary one. Both were streptococcal cases originating from a tonsillar infection. In both cases the organisms settled in the/

the uterus and produced an endometritis. From there in one case the Streptococci spread by the uterine veins to the parametrium and the general circulation. In the other, they spread along the surface to the tubes and thence to the Peritoneum, causing death from peritonitis. There is no absolute evidence, however that the organisms in these cases reached the uterus by the blood stream and not by carelessness in nursing.

Schäfer[59] reports a similar case where the primary focus was in the Frontal Sinus, which had been infected for 3 weeks before delivery. On the 6th day of the puerperium the patient's temperature rose with a rigor, and small Gram-negative bacilli could be found in the blood. The patient died on the 10th day and post-mortem a general septic state was found. The bacilli were recovered from the Frontal Sinus where the inflammation was found to have passed on to suppuration, but the organisms were also found in the Spleen, the Peritoneum, and in the Uterus itself.

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## THE QUESTION OF TREATMENT.

We have therefore seen that during an incomplete abortion the uterine cavity is always infected. The organisms may be saprophytic and live in the ovum, or they may attack the living tissues according to their nature. It has been shown that these two types of infection are not mutually exclusive and may coexist even in fatal cases. If an incomplete abortion becomes febrile, the rise of temperature is due to any or all of three conditions:- (1) Insufficient drainage. (2) Repeated reinfection of the blood with relatively harmless organisms, if the patient is having pains. (3) True infection of the uterus which may heal independently of any putrefaction which may be present or which may spread as described under Morbid Anatomy.

We have also seen that cases with a foul discharge need not have any rise of temperature, and that cases belonging to group 3 may recover though the discharge remains foul, and there is still something in the uterus. In any case it is obvious that there is no sharp division of cases possible into sapraemic and septic from the examination of the lochia. The term "Sapraemia" has become synonymous with a clinically mild case, irrespective of the pathology, and should therefore be abandoned.

Any/

Any of the organisms in the uterine cavity may reach the circulation through the uterine veins if the uterus is contracting. These organisms are not necessarily pathogenic and indeed it seems to be rather the less pathogenic organisms lying free in the uterine cavity which are disseminated thus.

If we attempt to remove the uterine contents we are again liable to cause a massive inoculation of the saprophytic organisms into the circulation. This alone causes no harm, but there is the greater danger of spreading any pathogenic organism which may be present. These organisms are attacking the living endometrium, and when this inflamed surface is interfered with, they are inoculated deeper into the tissues and even into the veins themselves. In the ordinary course of events they would have to penetrate into the tissues of the uterine wall to reach the blood stream, and they would probably be checked by nature's barrier. It is futile to attempt to disinfect the uterine cavity in the presence of such organisms by mere removal of a piece of placenta.

The method of treatment should depend on which of the above dangers is the greater - that of constant reinfection of the blood stream by relatively harmless organisms, till the ovum is naturally expelled, or the risk of spreading pathogenic organisms during artificial delivery. If the former is the greater danger then the/

the sooner the uterus is emptied the better, but if the latter risk is greater, then treatment should be conservative, i.e. the patient should be kept in bed, given pituitrin or quinine, an icebag over the lower part of the abdomen, and allowed to deliver herself. Even though something remains in the uterus, the temperature will fall as the infection is dealt with by the patient's natural resistance, and any operative measures can be carried out later.

Which method is preferable can only be decided by giving fair trial to both over a long series of cases. In many cases the mere fact of being confined to bed on a suitable diet seems to cause the temperature to settle, so that in the majority of cases it falls within 2 or 3 days of admission to hospital. Had the patient been curetted this improvement would no doubt have been attributed thereto.

Very few observers have had the courage to try conservative treatment. Many condemn it but without fair trial. They have limited this method of treatment to those hopeless cases where it is obvious that nothing will save the patient, and where there is some definite extrauterine complication, and have compared their results with those obtained by the active treatment of simple uncomplicated febrile cases.

Again, many writers admit the reasonable foundation of the conservative method of treatment but have not/

not dared to try it in the face of public opinion. For example, Halban[24], who always employs the active method, admits that harm can be done by it in a certain proportion of cases, but as his results are fairly good by this method he has never tried the other.

Among those who have given conservative treatment a really fair trial, and reported the results obtained are Winter[84 & 85], Traugott[69], Latzko[37], Offermann[47].

Winter says - do not operate if haemolytic streptococci are present in the Vagina. Wait till the patient's temperature has settled and the Streptococci have disappeared or become non-haemolytic, and operate then if necessary. In other cases there is no danger in immediately emptying the Uterus.

Traugott goes further and says it is dangerous to interfere if streptococci of any sort are present in the Vagina. All should be regarded as potentially pathogenic, and bacteriological methods give no indication of their virulence. In the presence of other organisms alone, it is permissible to operate.

Latzko says - leave it to nature, no matter what the bacteriology. After the temperature has settled for some days, operate if necessary. His conclusion is reached by his experience of 9000 abortion cases, stretching over a period of 18 years. In the first 12 years all cases were actively treated, and in the next 6 the conservative method was used. 2844 of the actively/

actively treated cases were febrile on admission and 2199 of the conservatively treated series. This is the only sort of series on which an opinion which is to be of any value, can be based. Over this long period the mortality of febrile cases with immediate active treatment was 5% and with conservative treatment the mortality was 3.6% - a relatively small difference but a powerful argument when the number of cases is considered.

Even Traugott's series of 237 Streptococcal cases is rather small. His cases were all uncomplicated abortions infected with streptococci. 99 were actively treated, and 138 conservatively, with 14 extrauterine complications and 18 deaths among the former and 4 extrauterine complications and 3 deaths among the latter.

Schottmüller's opinion[63] that the uterus should be emptied at once because of the danger of repeated inoculation of bacteria into the blood is based on a small series of 70 febrile streptococcal cases. If his series is analysed it will be found that he is comparing 52 actively treated cases including only 4 complicated ones with 18 expectantly treated cases, of which 12 on admission had already extrauterine complications. The comparison is of course unfavourable to the expectant method of treatment. Rather should he have contrasted his 48 uncomplicated cases all curetted/

curetted on admission, several of which had resulting extrauterine complications with one death, with his 6 expectantly treated uncomplicated cases, all of which recovered without any morbid results. Statistics treated in this way can be made to prove almost anything.

There are two points on which practically all writers are agreed. One is that severe persistent bleeding which is likely to endanger the patient's life is an indication for emptying the uterus no matter what the bacteriology or the temperature, or the condition of affairs outside the uterus. The second is that if a case has any evidence of extrauterine complications more harm than good will result from interference and the case is better left alone. A simple bacteraemia is not reckoned by these observers for this purpose as an extrauterine complication. Thrombophlebitis of the veins of the parametrium, parametritis, salpingitis, pelvic peritonitis, are all lesions contra-indicating intrauterine manipulations. There the organisms have spread beyond the uterus and the secondary lesions are foci from which further spread takes place and they are not affected though the original source of infection is destroyed, or becomes healed. In addition, and this is much more important, the necessary manipulation of the uterus for curettage or douching, always disturbs the surrounding parts,/

parts, and disturbs the barriers nature has been building up. It is particularly dangerous in cases of Thrombophlebitis where septic emboli are loosened, and the process spreads, or even generalised sepsis results. Early cases of phlebitis in the uterine veins are moreover very difficult to diagnose.

I do not do more here than suggest that in febrile abortion cases from all the above evidence, expectant treatment is well worth trying. Once the temperature has settled, the remnants may be removed.

With fever in the puerperium, however, the indications are much more definite. Here we have not to deal with transient bacteraemias as a cause of Temperature. If a patient is febrile, the temperature is due either to (1) Insufficient drainage or (2) True infection with virulent organisms.

Lindig[39] has shown that a piece of placenta may remain in the uterus for days without causing a rise of temperature, and then come away spontaneously. He has collected from the literature 165 cases with retained placenta, where the placenta remained in utero for varying periods up to 6 months. 98 remained afebrile. 75 had slight fever, 6 had a severe illness and one was fatal. Therefore it does not seem as though the mere presence of the placenta in the uterus can determine whether the case is to become infected with pathogenic organisms or not. Bumm believes in removing/

removing the placenta after labour is over[10], if it fails to come away spontaneously. But if this cannot be, or is not done immediately, it is better to leave it alone. Similarly if temperature develops he removes large necrotic loose pieces, but leaves smaller pieces of tissue in the uterus.

Certainly the organisms normally present in the puerperal uterus flourish in the disintegrating tissues, but if drainage is satisfactory no toxic absorption should take place. MacCallum in his Text-Book of Pathology (p. 248) compares the condition to a contused and infected wound which is stitched up and the patient develops a temperature and is poisoned by toxic absorption from the putrefying dead matter inside the wound. The two conditions are not at all similar. In the puerperium sufficient drainage is possible, and any pieces of tissue temporarily blocking the outlet may be gently removed.

More pathogenic organisms, the principal but not the sole variety being Streptococci, attack the living rather than dead tissues. If they reach the uterus during or within a few hours of delivery, while the veins are still open, they may cause an acute fulminating septicaemia but these cases are relatively rare. The usual order of attack is first of all the endometrium. The deeper tissues react by producing a protective leucocyte barrier to stem the advance of the invaders. If the organisms have sufficient penetrating/

penetrating power, i.e. are sufficiently virulent, or if the patient's resistance is poor, they may reach the lymphatics or veins of the uterine wall. If they are less virulent they will cause only a surface inflammation. But in any case it is easy to understand what the result would be were any manipulation undertaken with a view to removing a retained piece of placenta, especially if the curette were used. Fresh wounds are made on the inner surface of the soft uterus. The protective barrier is destroyed. The virulent organisms are implanted deeper into the tissues and enabled to gain a start on the natural defence. The newly-formed thrombi in the large veins of the placental site are opened up, the organisms may be directly inoculated into them, or what more frequently happens, minute infected thrombi are loosened, organisms are set free from them, the infection spreads, and a typical true thrombo phlebitis of the large pelvic veins results, and perhaps ends fatally.

Douching is condemned by many because of the danger of peritonitis following it (Schäfer is one of its opponents on this account), and in the early puerperium where the mouths of the veins are not firmly closed, of introducing organisms directly into the circulation. Later in the puerperium it is not so dangerous.

Therefore toxic absorption due to retention of lochia/

lochia is easily remedied by facilitating drainage. A putrid endometritis with or without a retained piece of placenta will heal of itself and need not cause a rise in temperature if its products can escape freely. Fowler's position is valuable in these cases. Bumm[10] reckons that 70% of cases with febrile puerperium are due to bad drainage in such cases. If there is in addition an infection by virulent organisms it does not affect the remnant of placenta and the mere removal of the piece of placenta, even though it did no harm would not improve matters. In addition there is always the real danger of spreading infection further. The endometritis cannot be removed and the uterus disinfected by curettage. Halle[26] has shown by examining the uterine secretion before and after curettage that whereas a mixed infection of Streptococci with other organisms was present before operation, operation got rid of the other organisms but left the Streptococci in pure culture.

There is a much better chance of the condition healing if left alone. As long ago as 1908, Fromme said:- A therapy which aims at increasing the strength of the whole body and which leaves the infected parts, especially the uterus, at rest, and at the same time develops the natural resistance is indicated here.

Therefore in treating Puerperal Fever it is best to rely on rest, Fowler's position, quinine, the ice bag,/

bag, and general dietetic - hygienic treatment. General remedies, e.g. Anti-Streptococcal serum, Arsenobenzol, Vaccines, may be tried though results with these are very variable. Bleeding which endangers life calls for operative treatment. Parametrian abscesses must be opened, Peritonitis must be drained, Veins may be ligated on analogy with the treatment of Lateral Sinus Thrombosis from Middle Ear Disease - though as has been pointed out, very few puerperal cases are suitable for this, metastases, periphlebitis, and concurrent spread by other paths than the blood stream are contra-indications. Even Warnekros from his wide experience of this type of case could quote only a few examples of recovery resulting from such an operation.

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## CONCLUSIONS.

The evidence which I have endeavoured above to collect, seems to point to the following facts:-

1. The Vagina frequently contains organisms, even haemolytic Streptococci, in apparently uninfected non-pregnant and pregnant patients. There is no evidence to prove that these are other than harmless saprophytes.
2. It is only in exceptional cases that these organisms are likely to cause Puerperal Fever.
3. Infection in the puerperium is therefore probably due to a recently introduced virulent organism or to one which has ascended from the Vulva after delivery.
4. The Vagina and Uterus always contain organisms, frequently Streptococci, in cases of incomplete abortion. These organisms can cause putrefaction in the Uterine contents without a rise of temperature if drainage is sufficient.
5. During contractions any or all of the organisms in the Uterus can and do reach the circulation. They cause rigors, but are soon destroyed by the blood. This type of bacteraemia is not a serious one.
6. Even when Streptococci appear in the blood under these circumstances, they are probably of the same variety/

variety as the harmless saprophytic Streptococci found in the aborting uterus.

7. Mechanical intrauterine manipulations in these cases likewise cause a flooding of the blood stream with organisms.

8. In a certain proportion of febrile abortion cases, actual infection with virulent organisms is present, and operative interference in these cases causes dissemination of the organisms into the blood stream, and inoculation more deeply into the tissues.

9. In the puerperium itself organisms do not invade the blood stream from the interior of the uterus in the same massive way unless there is interference.

10. When organisms <u>do</u> appear spontaneously they are in the vast majority of cases pathogenic and are derived from a septic phlebitis, or an endocarditis, or a general septicaemia is present.

11. In the puerperium as in incomplete abortion, interference can cause invasion of the blood-stream from the interior of the Uterus and can convert a surface inflammation into a general blood infection.

12. The retention of a piece of placenta is not the factor which determines whether a patient is going to develop a severe infection or not.

13 No attempt should be made to remove such a piece of placenta while the patient is febrile, because of the above danger.

14. Severe bleeding which is likely to endanger life is the only indication for intrauterine manipulation in these cases.

In conclusion I wish to express my thanks to all those who have so readily given me facilities for obtaining cases - to Dr Ker for permission to examine those at the City Hospital, to Dr Rose for those at the Hospice, to Dr Browne for the cases from the Antenatal Clinic, to the Staff of the Royal Maternity Hospital, and above all to Professor Mackie for valuable advice on Bacteriological questions and to Professor Watson for his never-failing help and much appreciated encouragement.

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## A. GYNECOLOGICAL CASES.

| Case. | Diagnosis. | Married or Single. | Multipara or Nullipara. | Organisms found. | Remarks. |
|---|---|---|---|---|---|
| 1. | Incomplete Abortion 3rd month. | M. | M. | Diphtheroids in pure culture | No temperature. Foul discharge. Bleeding for 6 days. No reaction after curettage |
| 2. | Threatened abortion 4½ months. | M. | M. | B. Proteus, Staphylococcus Albus. Large gram-positive bacilli with rounded ends. Streptococcus Salivarius. | Much bleeding therefore Uterus emptied. No reaction. |
| 3. | Incomplete abortion 3rd month. | M. | M. | Staphylococcus Albus. Diphtheroid Bacilli. | Bleeding for 8 days. Slight rise of temperature after operation (101°). |
| 4. | Incomplete abortion 3rd month. | M. | M. | Streptococcus mitis in pure culture. | Had been bleeding for 4 weeks. Had had slight temperature for first few days. No reaction after operation. |
| 5. | Incomplete abortion 3rd month. | M. | M. | A few Staphylococcus Albus. Many Streptococci - S. Anginosus. | Bleeding 8 days. No Temperature before or after operation. |
| 6. | ?Missed abortion 3 months previously. Uterus empty. | M. | M. | 2 colonies Diphtheroids. A few colonies of Staphylococcus Albus. | No reaction. |

| Case. | Diagnosis. | Married or Single. | Multipara or Nullipara. | Organisms found. | Remarks. |
|---|---|---|---|---|---|
| 7. | Repeated accidental haemorrhages. 4½ months pregnancy. | M. | M. | Staphylococcus Albus. | Uterus size of 6 months pregnancy. Vaginal hysterotomy. Membranes intact. |
| 8. | Incomplete abortion 3 months. | M. | M. | B. Coli. Staphylococcus Albus. Streptococcus Mitis. | No reaction. |
| 9. | 2½ months pregnancy. | M. | M. | B. Coli. | Complicated by Appendix absce |
| 10. | Retroverted Gravid Uterus. | M. | M. | B. Coli. Staphylococcus Albus | Had been wearing pessary. |
| 11. | 2½ months pregnancy. | M. | M. | B. Coli. | Rectocele and Cystocele. |
| 12. | Cervical Polypus. | M. | M. | Sterile. | Had had much haemorrhage. |
| 13. | Multiple Cervical Polypi. | M. | M. | Streptococcus non-haemolyticus II. B. Coli. | Much bleeding. |
| 14. | Ectopic Gestation. | M. | M. | Streptococcus Faecalis | |
| 15. | Ectopic Gestation. | M. | M. | Sterile. | Patient's second Ectopic Pregnancy. |
| 16. | Simple Ovarian Cyst. | S. | N. | Sterile | |
| 17. | Pelvic Varicocele | M. | N. | Streptococcus Mitis. | Had been wearing pessary. |

| Case. | Diagnosis. | Married or Single. | Multipara or Nullipara. | Organisms found. | Remarks. |
|---|---|---|---|---|---|
| 18. | Fibroids (subperitoneal and interstitial). | M. | N. | Sterile. | Hysterectomy. |
| 19. | Fibroid (large submucous). | M. | N. | Sterile. | Hysterectomy. |
| 20. | Interstitial Fibroid. | | | B. Coli. | Curetted. |
| 21. | Fibrosis Uteri. | M. | M. | Sterile. | |
| 22. | Fibrosis Uteri. | M. | M. | B. Coli. Staphylococcus Albus. | |
| 23. | Fibrosis Uteri. | M. | M. | Sterile. | - |
| 24. | Carcinoma of Cervix. | M. | M. | B. Proteus. Diphtheroids. Staphylococcus Albus. Streptococcus Mitis. | - |
| 25. | Carcinoma of Body. | S. | N. | Sterile. | - |
| 26. | Normal Uterus &c. | M. | N. | Staphylococcus Albus. | Hysterical condition. Complaint - dysmenorrhoea. |
| 27. | Dysmenorrhoea. | M. | N. | B. Proteus. Staphylococcus Albus. | |
| 28. | Anteflexed Uterus. Tuberculosis of Tubes and Ovaries. | M. | N. | B. Coli. | Dysmenorrhoea. |

| Case. | Diagnosis. | Married or Single. | Multipara or Nullipara. | Organisms Found. | Remarks. |
|---|---|---|---|---|---|
| 29. | Anteflexed uterus. | S. | N. | Sterile. | Dysmenorrhoea. |
| 30. | Anteflexed uterus. | S. | N. | Sterile. | Dysmenorrhoea. |
| 31. | Underdeveloped Uterus | S. | N. | Sterile. | Catarrhal discharge from Cervix |
| 32. | Chronic infection. | S. | N. | B. Coli. Streptococcus Faecalis. | Had had appendix removed, also left tube and ovary for chronic pain. Curetted. |
| 33. | Cystocele and deficient Pelvic Floor. | M. | M. | Staphylococcus Albus. | |
| 34. | Cystocele. Rectocele, Deficient pelvic floor. | M. | M. | Staphylococcus Albus. B. Coli. Streptococcus Mitis. | |
| 35. | Cystocele with deficient pelvic floor. | M. | M. | Diphtheroids. | |
| 36. | Prolapse Cystocele and deficient pelvic floor. | M. | M. | Staphylococcus Albus. B. Coli. Diphtheroids. | |
| 37. | Cystocele with slight deficiency of pelvic floor. | M. | M. | Sterile. | |
| 38. | Cystocele. | M. | M. | Sterile. | After supravaginal hysterectomy 8 years previously. |
| 39. | Deficient pelvic floor. | M. | M. | Streptococcus Faecalis. | |

| Case. | Diagnosis. | Married or Single. | Multipara or Nullipara. | Organisms found. | Remarks. |
|---|---|---|---|---|---|
| 40. | Cystocele and deficient pelvic floor. | M. | M. | B. Coli. Streptococci in long chains. Doubtfully haemolytic - Str. Mitis. | |
| 41. | Cystocele. | M. | M. | Diphtheroids. Streptococcus Salivaris. | Recurrent cystocele. |
| 42. | Lacerated Cervix with deficient pelvic floor. | M. | M. | Sterile. | |
| 43. | Cystocele, Rectocele, deficient Pelvic Floor. | M. | M. | Streptococcus Faecalis. | |
| 44. | Cystocele and deficient pelvic floor. | M. | M. | Staphylococcus Albus. Streptococcus Mitis. | |
| 45. | Cystocele. Hypertrophied Cervix. Deficient pelvic floor. | M. | M. | Staphylococcus Albus. Diphtheroids. | |
| 46. | Cystocele, Deficient Pelvic floor. Large hypertrophied cervix. | M. | M. | B. Coli. | |
| 47. | Cystocele and deficient Pelvic Floor. | M. | M. | B. Coli (2 colonies). B. Proteus. Streptococcus Mitis(many). | |
| 48. | Deficient pelvic floor. | M. | M. | Sterile. | |
| 49. | Cystocele. Deficient pelvic floor. | M. | M. | Streptococcus Mitis. | |
| 50. | Cystocele. Deficient Pelvic Floor. | M. | M. | B. Coli. | |

| Case | Diagnosis. | Married or Single. | Multipara or Nullipara. | Organisms found. | Remarks. |
|---|---|---|---|---|---|
| 51. | Cystocele and deficient Pelvic floor | M. | M. | B. Coli. Streptococcus Mitis. Streptococcus Faecalis. | |
| 52. | Cystocele, Rectocele. Deficient Pelvic Floor. | M. | M. | B. Coli. Staphylococcus Albus. Large gram-positive non-sporing bacilli. | |
| 53. | Endometritis. | M. | M. | Sterile. | Leucorrhoea. |
| 54. | Enlarged lacerated Cervix. | M. | M. | B. Proteus. Diphtheroids. Staphylococcus Albus. | |
| 55. | Endometritis. | M. | M. | B. Coli. | Leucorrhoea, (foul-smelling). Bladder symptoms. |
| 56. | Lacerated Cervix. | M. | M. | Sterile. | |
| 57. | Lacerated Cervix. | M. | M. | Sterile. | |
| 58. | Endometritis. | M. | M. | Streptococcus Mitis. Staphylococcus Albus. Diphtheroids. | Leucorrhoea. |
| 59. | Endometritis. | M. | M. | Streptococcus Faecalis. | Leucorrhoea. |
| 60. | Cervical Erosion. | M. | M. | Sterile. | Neurasthenia. |

| Case. | Diagnosis. | Married or Single. | Multipara or Nullipara. | Organisms found. | Remarks. |
|---|---|---|---|---|---|
| 61. | Lacerated Cervix. | M. | M. | Sterile. | |
| 62. | Endometritis. | S. | N. | Streptococcus Mitis. | Leucorrhoea since Menarche |
| 63. | Lacerated Cervix. | M. | M. | Sterile. | |
| 64. | Lacerated Cervix. | M. | M. | B. Coli.<br>Streptococcus Albus.<br>Streptococcus Mitis. | |
| 65. | Retroflexed Uterus with inflamed appendages. | M. | M. | Sterile. | |
| 66. | Cyst of Broad Ligament - result of previous operation on Tubes and Ovaries. | M. | M. | Diphtheroids. | |
| 67. | Salpingitis with unilateral pyosalpinx. | M. | M. | Sterile. | |
| 68. | Leucorrhoea from old puerperal infection. | M. | M. | Diphtheroids.<br>Staphylococcus Albus.<br>Streptococcus Faecalis. | Vagina tent-shaped. Cervi fixed and adherent to Vaginal walls. |
| 69. | Chronic Inflammation of appendages. | M. | M. | B. Coli.<br>Staphylococcus Albus. | |
| 70. | Pelvic Peritonitis | M. | M. | B. Coli.<br>Staphylococcus Albus.<br>(B. Coli in pus ? from appendix). | |

## B. PREGNANT PATIENTS.

| Case No. | Primipara or Multipara. | Organisms found. |
|---|---|---|
| 1. | P. | Staphylococcus Albus (a few). |
| 2. | P. | Staphylococcus Albus. |
| 3. | M. | Many minute colonies of large Gram-positive non-sporing bacilli with square ends. |
| 4. | M. | Small diphtheroid bacilli. |
| 5. | M. | Diphtheroids, Staphylococcus Albus. |
| 6. | M. | Staphylococcus Albus. |
| 7. | P. | Sterile. |
| 8. | P. | Large Diphtheroids. |
| 9. | M. | A few small Diphtheroids. |
| 10. | M. (no perineum) | B. Coli, Staphylococcus Albus, Streptococci. |
| 11. | P. | A few colonies of Staphylococcus Albus. Streptococci. |
| 12. | P. | Staphylococcus Albus. |
| 13. | M. | Staphylococcus Albus (a few). |
| 14. | M. | Sterile. |
| 15. | P. | Sterile. |
| 16. | M. | Large Diphtheroids. |
| 17. | M. | Small Diphtheroids. |
| 18. | P. | Streptococci. |
| 19. | P. | Sterile. |
| 20. | P. | Large Diphtheroid Bacilli. |
| 21. | M. | Sterile. |
| 22. | M. | Several large colonies of large Gram-positive bacilli with round ends. |

| Case No. | Multipara or Primipara. | Organisms found. |
|---|---|---|
| 23. | P. | Diphtheroid Bacilli. |
| 24. | P. | A few diphtheroids. |
| 25. | P. | Sterile. |
| 26. | P. | Streptococci; Staphylococcus Albus. |
| 27. | M. | Streptococci; Staphylococcus Albus. |
| 28. | P. | Staphylococcus Aureus, Staphylococcus Albus, Diphtheroid Bacilli. |
| 29. | M. | Staphylococcus Albus. Diphtheroids. |
| 30. | M. | Streptococci; Staphylococcus Albus. |
| 31. | M. | Staphylococcus Albus. |
| 32. | M. | Staphylococcus Albus. Diphtheroids. |
| 33. | P. | Streptococci. Staphylococcus Albus. |
| 34. | M. | Staphylococcus Albus, Diphtheroids. |
| 35. | P. | Staphylococcus Albus, Diphtheroids. |
| 36. | M. | Yeasts, Staphylococcus Albus, Diphtheroid |
| 37. | M. | Diphtheroid Bacilli. |
| 38. | M. | B. Coli. |
| 39. | M. | Large Gram-positive bacilli in minute colonies. |
| 40. | P. | Sterile. |
| 41. | P. | Sterile. |
| 42. | P. | Staphylococcus Albus. |
| 43. | P. | Staphylococcus Albus, Streptococci. |
| 44. | P. | Large and small Diphtheroids. |
| 45. | M. | Staphylococcus Albus.<br>Large Diphtheroid Bacilli. |

| Case No. | Multipara or Primipara. | Organisms found. |
|---|---|---|
| 46. | M. | Staphylococcus Albus. Small Diphtheroids. |
| 47. | M. | Diphtheroids. Streptococci. |
| 48. | M. | Large and small Diphtheroids. |
| 49. | M. | Diphtheroid Bacilli (small). |
| 50. | P. | Staphylococcus Albus, Diphtheroids. |
| 51. | M. | Staphylococcus Albus, Large Diphtheroids. |
| 52. | M. | Staphylococcus Albus. Streptococci. |
| 53. | P. | Staphylococcus Albus, Diphtheroids. |
| 54. | M. | Staphylococcus Albus, Diphtheroids. |
| 55. | M. | Diphtheroid Bacilli. |
| 56. | M. | 2 colonies Diphtheroid Bacilli. |
| 57. | M. | Diphtheroid Bacilli. |
| 58. | P. | Staphylococcus Albus. Large and small Diphtheroids. |
| 59. | M. | Yeasts. Staphylococcus Albus. |
| 60. | P. | Streptococci. |
| 61. | M. | Staphylococcus Albus, Large Diphtheroids. |
| 62. | M. (no perineum) | B. Coli. |
| 63. | P. | Diphtheroid Bacilli. |
| 64. | P. | Large Diphtheroid Bacilli. |
| 65. | M. | B. Coli. |
| 66. | M. | Sarcinae, Diphtheroid Bacilli. |
| 67. | M. | Staphylococcus Albus. |
| 68. | P. | Sarcinae. |
| 69. | P. | Staphylococcus Albus. |
| 70. | P. | Staphylococcus Albus. Small Diphtheroid Bacilli. |

## C. CASES OF PUERPERAL INFECTION.

Case 1.

Mrs B.

Aet. 35. Para 4.

In Labour from 6.5.23 - 8.5.23. Membranes ruptured early. Delivered instrumentally at home. Temperature rose 9.5.23.

24.5.23 sent to City Hospital. Temperature 103° - 104°. Pulse 140. No lochia.

29.5.23. Temperature 103°. Pulse 120. Culture made - sterile.

5.6.23. Temperature normal and remained so.

Case 2.

Jemima M.

Aet. 18. Para 1. Had Gonorrhoeal discharge. Delivered spontaneously 11.5.23. Large Vaginal tear, stitched.

Ran mild temperature - 98° - 99° for nearly 3 weeks, then suddenly on 29.5.23 temperature rose to 104°. Swung between 104° and Normal.

31.5.23. Temperature 102°. Pulse 110. No discharge. Nothing abnormal detected locally. Culture taken - sterile.

1.6.23. Temperature 100°. Patient much better. Thereafter in evenings temperature 99°. No further recrudescence.

Case 3.

Mrs W.

Aet. 23. Para 3.

Spontaneous labour 31.5.23.

5.6.23 morning temperature 103°. Pulse 118.
Headache. No rigor. Lochia normal.
Blood culture taken - negative.

6.6.23 and thereafter temperature normal.

Case 4.

Mrs Catherine D.

Aet. 33. Para 1.

Labour lasted from 7.6.23 - 10.6.23. Terminated in instrumental delivery, at home.

13.6.23. Temperature rose. Rigor.

16.6.23. Sent to City Hospital. Temperature 103°.

19.6.23. Temperature 102 - 104°. Pulse 120.
Very little discharge - not foul-smelling.
Blood culture - sterile.

26.6.23. Temperature still 102°. Blood culture repeated - sterile.

Two days later patient developed an abscess of the left labium. When this was opened her temperature fell. Unfortunately I did not obtain a sample of the pus.

25.7.23. Discharged from hospital.

Case 5.

Mrs B.

Aet. 26. Para 3.

Delivered instrumentally 20.6.23 at home.

23.6.23. Rigor and rise of temperature.

25.6.23. Sent to City Hospital. Temperature $102^{\circ}$ - $105^{\circ}$. Pulse 110 - 160. Delirious. Typical picture of septicaemia. A few rhonchi in lungs. Heart examination negative.

26.6.23. Temperature $103^{\circ}$. Pulse 130. Blood culture - sterile.

28.6.23. Temperature $104^{\circ}$. Blood culture - sterile.

2.7.23. Patient died. No post-mortem obtained.

Case 6.

Mrs E.

Aet. 33. Para 2. Abort. 1.

Admitted to Royal Maternity Hospital 23.7.23.

Delivered instrumentally. Temperature 102.6.

Had had several attempts at delivery made outside.

Joint pains in shoulder, hip and ankles. No rigors. Continuous temperature.

29.6.23. Temperature $103.6^{\circ}$. Unconscious. Pulse 160. Blood-culture - haemolytic streptococci (not classified further).

1.7.23. Died. No post-mortem.

Case 7.

Dorothy B.

Aet. 26. Para 1.

3.7.23. Instrumental delivery at home.

5.7.23. Rise of temperature.

7.7.23. Sent to City Hospital. Temperature 100 - 102°. Lochia normal.

9.7.23. Temperature 102°. Pulse 110. Blood culture - sterile.

11.7.23 and thereafter temperature normal.

Case 8.

Marion W.

Aet. 23. 4 months abortion.

21.7.23. Admitted Royal Infirmary, Edinburgh, with temperature.

22.7.23. Transferred to Royal Maternity Hospital. Temperature 100 - 101°. Pulse 120-100. Uterus emptied. Temperature fell.

24.7.23. Temperature 101.6°. Blood culture - sterile. Temperature settled within a few days.

Case 9.

Annie N.

Aet. 26. Para 1.

17.7.23. Packed to induce labour.

21.7.23. Again packed.

24.7.23. Delivered spontaneously, 1.30 a.m. Douched afterwards.

25.7.23. 1.30 a.m. Rigor. Temperature 104°. Pulse 140.

9.30 a.m. Rigor. Temperature 103°.

10.30 a.m. Blood culture - Abundant growth of Gram-negative bacilli. On subculture these were found to be motile, they did not liquefy gelatin, and they produced Acid and Gas in Peptone water containing Glucose, Lactose, Mannite, Dulcite but not Saccharose or Inulin. The fermentation of Lactose was weak and was more distinct on a McConkey plate than in Lactose peptone water. They also produced Acid and Clot in litmus milk and Indol in Peptone Water. Therefore the organisms were B. Coli.

27.7.23. Temperature 102.2°. Patient drowsy, Lochia not foul smelling. Blood culture - sterile.

30.7.23. Temperature normal and remained so.

Case 10.

Mrs F.

Aet. 26. Para 1.

6.9.23. Forceps delivery.

7.9.23. Temperature 99°.

9.9.23./

9.9.23. Temperature 102.8°. No change in lochia. Uterus normal. Pulse 100. Blood culture - sterile.

12.9.23. Temperature 99°. Thereafter normal.

Case 11.

Mrs F.

Aet. 28. Para 1. Abort 1.

11.9.23. Delivered spontaneously. Adherent membranes. Tear of vagina and perineum.

13.9.23. Temperature 99 - 100°.

14.9.23. Temperature 100.4°. Blood culture sterile. Lochia and Uterus normal. Pulse 98. Uneventful recovery.

Case 12.

Mrs W.

Aet. 22. Para 1.

8.9.23. Instrumental delivery at home. Vaginal and perineal tears.

11.9.23. Rise of temperature.

16.9.23. Sent to City Hospital. Temperature 101 - 103°. Pulse 90 - 130.

21.9.23. Temperature 102°. Erysipelatous patch spreading over buttocks from tear. Blood culture - sterile.

25.9.23./

25.9.23. Temperature 101 - 103°. Blood culture repeated - sterile.
Temperature was elevated for 10 days after this and then settled.

13.10.23. Discharged.

Case 13.

Mrs McL.

Aet. 23. Para 1.

7.10.23. Instrumental delivery. Torn Perineum.

9.10.23. Temperature 99°.

10.10.23. Temperature 100.8°. Blood culture - sterile. Lochia diminished.

11.10.23 and thereafter temperature normal.

Case 14.

Elizabeth P.

Aet. 23. Para 1.

28.9.23. Instrumental delivery.

1.10.23. Temperature rose 103°. Swung between normal and this level. Pulse 120-90.

16.10.23. Temperature 102°. Blood culture - sterile. Commencing periostitis of right humerus. Transferred to Craig-lockhart hospital.

Case 15.

Mrs M.

Aet. 33. Para 5.

22.10.23. Spontaneous delivery. No tears.

24.10.23. Evening temperature 102°. Slight rigor.

25.10.23. Morning temperature 100°. Pulse 110. Rose in afternoon to 103°. Blood culture - sterile. Lochia normal. Some tenderness in fornices.

27.10.23. Temperature normal.

Case 16.

Jane S.

Aet. 21. Para 1.

25.10.23. Admitted to hospital.

27.10.23. Instrumental delivery. Rigor. Temperature 103°. Pulse 120. Swinging temperature for next few days.

2.11.23. Temperature 104° in morning. Pulse 140. Blood culture - sterile. Temperature irregular for next few days. Settled in about a week.

Case 17.

Jenny L.

Aet. 28. Para 1.

2.11.23. Instrumental delivery. Membranes retained.

5.11.23 and 6.11.23. Temperature 102° in evenings.

7.11.23 - 11.11.23. Temperature normal. Pulse 80.

11.11.23. at 3.45 p.m. on account of some bleeding the membranes were removed, an intra-uterine douche given and the uterus packed. That evening the temperature rose to 102.8°. Pulse 130.

12.11.23. Temperature 103°. Blood culture - abundant growth of long-chained streptococci. These organisms showed no haemolytic ring when grown on Blood Ager. The liquid test was also negative. The organisms fermented Lactose and Mannite and therefore belonged to the group non-haemolyticus I of Holman. On intraperitoneal injection into two mice they produced necrosis at the point of inoculation and the animals died in 4 days of a septicaemia. The same Streptococci were recovered from their heart blood.

The patient's temperature continued to swing between normal and 103°. The right elbow became swollen and painful.

17.11.23. Blood culture repeated - Non-haemolytic streptococci still present.

19.11.23. Patient received 3 gm. N.A.B. intravenously. 24 hours later, streptococci still present in the blood, but growth not so abundant - the organisms were recognised only after 48 hours.

26.11.23. Further injection of N.A.B.

27.11.23. Transferred to City Hospital where she made a slow recovery. The inflammation of the right elbow receded but the right leg and thigh became swollen and tender, showing that the patient had a thrombosis in her larger pelvic veins, which had spread to her Femoral Vein. She developed abscesses - one peri-anal and one over the right trochanter, with non-haemolytic streptococci in the pus.

Finally her temperature settled and she was discharged on 26.1.24.

Case 18.

Mrs McD.

Aet. 21. Para 2.

3.11.23. Ante partum haemorrhage. Placenta Praevia. Labour induced. Delivered of a 7 months child. Torn perineum and cervix.

5.11.23. Temperature started to swing between normal and 102°. Pulse 90 - 104. Temperature normal on 11th and 12th.

13.11.23. Temperature 102°. Foetid lochia. Uterus well involuted.

14.11.23. Temperature 102°. Pulse 102. Blood culture - sterile. Temperature settled in 4 days.

Case 19.

Mrs C.

Aet. 38. Para 1.

7.11.23. Forceps delivery. Placenta expressed.

13.11.23. Temperature 102°. Pulse 110. Temperature irregular, varying from 103° - normal. Pulse 100 - 120.

19.11.23. Temperature 101.6°. Blood culture - sterile.

20.11.23. Temperature 103°. Blood culture - Sterile, Spleen enlarged, Widal reaction negative.

26.11.23. Died. No post-mortem.

Case 20.

Mrs H.

Aet. 28. Para 1.

15.11.23. Forceps delivery. Placenta expressed

16.11.23. Temperature and pain in left side.

19.11.23. Temperature 102°. Pulse 110. Blood culture - sterile.

23.11.23. Temperature 100°. Blood culture - sterile. Temperature settled in a few days.

Case 21.

Lily C.

Aet. 21. Para 1.

17.11.23. Spontaneous delivery.

19.11.23. Temperature 99° - 101°. Irregular. Pulse 90 - 100. Lochia normal.

23.11.23. Temperature 101°. Blood culture - sterile. Temperature settled within a week.

Case 22.

Mrs R.

Aet. 30. Para 1.

21.11.23. Delivered instrumentally.

24.11.23. Temperature 102°. Continuous temperature till 28.11.23 and then fell gradually.

3.12.23. Temperature 102°. Pulse 100 - 120.

4.12.23. Temperature 102°. Intrauterine douche. Followed by temperature of 104° in evening. Blood culture taken between the douche and the rise of temperature - sterile.

10.12.23. Blood culture repeated - sterile.
Temperature swinging - normal to 102°.
Discharged in a fortnight.

Case 23.

Mrs McN.

Aet. 30. Para 5.

Delivered 25.11.23 at home.

28.11.23. Rigor, headache, vomiting.

6.12.23. Admitted to City Hospital. Diarrhoea and abdominal pain. Tenderness in left iliac fossa. Dazed appearance. Temperature 100 - 102°. Pulse 90 - 120.

11.12.23. Temperature 102°. Pulse 125. Blood culture - sterile.

17.12.23. Patient died. No Post-Mortem.

Case 24.

Mrs D.

Aet. 21. Para 0. Abort 2.

3 months miscarriage.

11.12.23. Pain and bleeding. Shivering and headache. Discharge of ? ovum on 13.12.23.

14.12.23. Admitted to R.I.E. Temperature 102°. Pulse. 120.

17.12.23. Temperature 100°. Pulse 110. Blood culture sterile.

19.12.23. Temperature normal.

Case 25.

Ellen M.

Aet. 20. Abortion - 3rd month.

Bleeding, headache, shivering and rise of temperature for 10 days.

14.12.23. Pains began.

15.12.23. Admitted to Royal Infirmary Edinburgh. Temperature 102°. Pulse 115.

17.12.23. Temperature 102°. Blood culture - sterile.

19.12.23. Temperature normal.

Case 26.

Catherine C.

Aet. 20. Para 1.

14.12.23. Spontaneous delivery.

18.12.23. Rigor. Temperature 104°. Pulse 120.

19.12.23. Temperature 104° - 105°. Continuous. Lochia very scanty. Pulse 120. Respirations 20. No pains, or headache. Blood culture - sterile.

21.12.23. Blood culture repeated - sterile.

31.12.23. Sent to City Hospital. Improved for a few days. Suddenly developed convulsions and died 5.1.24. No post-mortem.

Case 27.

Mrs G.

Aet. 20. Para 1.

Spontaneous but prolonged labour.

12.12.23. Delivered. Temperature in evening 100°, thereafter 99° - 101°.

19.12.23. Temperature 101°. Pulse 110. Lochia slightly foetid. No symptoms. Blood culture - sterile. Temperature settled by 26.12.23.

Case 28.

Bella R.

Aet. 36. Para 1.

23.12.23. Spontaneous delivery.

29.12.23. Temperature 103°. Lochia foetid. Swinging temperature.

7.1.24. Temperature still normal - 103°. Respirations 112. Blood culture - sterile.

Temperature settled in 4 days.

Case 29.

Mrs McE.

Aet. 36. Para 7.

19.12.23. Spontaneous delivery.

21.12.23. Felt ill. No definite rigor.

28.12.23. Sent to Royal Infirmary Edinburgh and/

and thence transferred to City Hospital.

29.12.23. Temperature 103°. Pulse 120. Blood culture - An abundant growth of Streptococci - non-haemolytic and fermenting Lactose only. Therefore the organism was the Streptococcus Salivarius. Patient developed transient painful reddened swellings of the thigh and shoulder from which on incision no pus escaped.

8.1.24. Temperature 100°. Blood culture - no growth. Temperature irregular with remissions.

22.1.24. Sudden rise of Temperature to 103°. Blood culture taken - still negative. Temperature gradually settled and patient got up. She then developed a thrombosis of the veins of the right leg and was once more confined to bed. She was not discharged till about 6 weeks after this.

The streptococcus isolated from this case produced a general septicaemia in a rabbit and killed it in 10 days. The animal lost 600 gms. in that time. The same streptococci were recovered from the heart blood. There was no secondary foci of infection.

Case 30.

Mrs M.

Aet. 22. Para 2.

8.1.24. Precipitate labour.

10.1.24. Temperature 102.6°. Pulse 112.

11.1.24. Temperature 101.8° in morning. Rose in evening to 104°. Blood culture - sterile. Lochia normal. Stye in left eye. Temperature sank steadily within 3 days.

24.1.24. Sudden rise of temperature to 103°. Abscess at site of intramuscular quinine injections. When this was opened the patient made a smooth recovery. Cultures were made from the pus and Haemolytic Streptococci were found in pure culture. These fermented Lactose, Mannite and Salicin. They therefore belonged to the group Streptococcus Infrequens of Holman. When injected intravenously into a rabbit the organisms caused death in 9 days. There were no secondary foci and the organisms were recovered from the heart blood. The animal had therefore died of a septicaemia.

Case 31./

Case 31.

Mrs McL.

Aet. 22. Para 4.

31.12.23. Precipitate labour.

3.1.24. Temperature 101°. Pulse 128. Headache and abdominal pain.

10.1.24. Sent to City Hospital.

14.1.24. Temperature 101°. Pulse 130. Blood culture - sterile.

17.1.24. Temperature normal.

2.2.24. Discharged.

Case 32.

Mrs C.

Aet. 38. Para 1.

Labour 13.1.24 - 15.1.24.

Instrumental delivery. 10 lb. child. Large perineal tear.

20.1.24. Temperature 101°. Pulse 100. Slight jaundice.

21.1.24. Temperature 101°. Pulse 110. Still jaundiced. Blood culture - sterile.

23.1.24. Temperature normal.

Case 33.

Edith M.

Aet. 24. Para 1.

25.1.24. Delivered spontaneously.

3.2.24./

3.2.24. Morning temperature 101°. Evening 102°. Lochia normal.

4.2.24. Temperature 101.5°. Pulse 116 - 120. Blood culture - sterile.

6.2.24. Temperature normal.

Case 34.

Lily G.

Aet. 19. Para 1.

31.1.24. Delivered spontaneously. Membranes artificially ruptured.

2.2.24. Evening temperature 103°.

4.2.24. Temperature 102°. Pulse 140. Respirations 34. Blood culture - sterile. Temperature fell gradually. Pneumonic patch in right lung. Temperature normal 10.2.24.

Case 35.

Mrs R.

Aet. 22. Para 1.

Labour lasted 64 hrs. 10 mins. Forceps delivery attempted several times. Finally delivered by craniotomy 4.2.24.

11.2.24. Two rigors. Temperature 105°. Fell at once.

12.2.24. Slight rigor. Temperature 101°. Pulse 112. Blood culture - sterile. Temperature fell in next two days. No further rigors.

Case 36.

Mrs C.

Aet. 37. Para 1.

Eclamptic.

4.2.24. Delivered instrumentally. Thereafter ran an irregular temperature 99 - 101°. Pulse 100 - 110.

13.2.24. Blood culture - sterile.

Temperature settled 17.2.24.

Case 37.

Mrs M.

Aet. 42. Para 10.

1.2.24. Spontaneous delivery.

3.2.24. Rigor. Temperature 103° in evening. Fell immediately. Blood culture next morning - sterile. Temperature remained normal till 7.2.24.

7.2.24. Temperature rose to 103°. Gluteal abscess at site of intramuscular quinine injection opened, and temperature fell. The abscess contained streptococci in pure culture. These were haemolytic and fermented Lactose and Salicin. They therefore corresponded to the type Streptococcus Pyogenes. 3 agar slopes of the organism were injected into a rabbit and the animal lost weight for a few days but soon recovered.

Case 38.

Mrs McD.

Aet. 32. Para 1.

3.2.24. Instrumental delivery. Torn Perineum.

9.2.24. Temperature 103°. Fell to normal but rose again and continued irregularly from 10.2.24. onwards.

14.2.24. Temperature 101.5°. Pulse 132. Blood culture - sterile. Temperature continued to swing from normal to 102°. Pain in left iliac fossa.

22.2.24. Temperature 102°. Blood culture repeated - sterile.

Temperature did not settle till a fortnight later.

Case 39.

Mrs V.

Aet. 26. Para 1.

10.2.24. Caesarean Section.

11.2.24. Temperature 101°. Pulse 120.

Temperature swung between 99° and 102°.

15.2.24. Temperature 102°. Pulse 116. Blood culture - sterile.

Much discharge.

Temperature settled in 3 or 4 days.

Case 40.

Mrs K.

Aet. 35. Para 2.

4.2.24. Spontaneous delivery.

13.2.24. Temperature rose. Irregular type. Varied between normal and 103°.

18.2.24. Temperature 102.8°. Blood culture - sterile.

22.2.24. Temperature normal.

Case 41.

Mrs N.

Aet. 25. Para 2.

16.2.24. Spontaneous delivery.

19.2.24. Temperature 101°. Lochia normal.

20.2.24. Temperature 102°. Pulse 110.

21.2.24. Temperature 101.6°. Pulse 96. Blood culture - sterile.

22.2.24. Temperature normal.

Case 42.

Lillian Q.

Aet. 18. Para 1.

22.2.24. Spontaneous delivery.

24.2.24. 8 a.m. Temperature 102° Pulse 116. Blood culture (10 a.m) sterile. No rigor. Slight headache. Lochia normal.

27.2.24. Temperature normal.

Case 43.

Mrs E.

Aet. 30. Para 2 (twins).

19.2.24. Delivered. Much interference. Had to dilate cervix to remove second twin. Placenta manually removed.

23.2.24. Temperature 102°. Pulse 128.

24.2.24. Temperature 103.4°. Pulse 130. Blood culture - sterile. Temperature fell gradually.

6.3.24. Temperature normal.

Case 44.

Mrs McM.

Aet. 43. Para 15.

23.2.24. Delivered by version. Child dead. Forceps had been attempted at home.

24.2.24. Rigor. Temperature 104°. Pulse 108. 4 rigors between 25.2.24 and 26.2.24. Lochia very foul-smelling.

26.2.24. Temperature between rigors irregular. Normal to 101.5°. Blood culture 8 hours after rigor - sterile.

1.3.24. Rigor. Temperature 105°. Temperature fell.

2.3.24. 10 p.m. Rigor. Temperature 106° Blood culture next morning - sterile.

5.3.24. Sent to City Hospital.

9.3.24./

9.3.24. Temperature 101°. Had had rigor during the early morning. Blood culture - sterile. Temperature settled. Discharged about a fortnight later.

Case 45.

Mrs R.

Aet. 23. Para 1.

23.2.24. Forceps delivery. Torn Perineum.

27.2.24. Temperature 101°.

28.2.24. Temperature 102° and fell gradually.

3.3.24. Evening temperature 104.6°.

4.3.24. Temperature 102°. Blood culture - sterile.

8.3.24. Temperature settled.

Case 46.

Flora McL.

Aet. 19. Para 1.

23.2.24. Spontaneous delivery after long labour.

26.2.24. Temperature 103°. Pulse 120. Lochia normal. Irregular temperature there afterwards.

6.3.24. Temperature 102.8°. Pulse 120. Blood culture - sterile.

That afternoon a Gluteal abscess at the site of a Quinine injection ruptured. Cultures were made from the pus and yielded a pure growth of Streptococcus Pyogenes. Thereafter the temperature settled.

Case 47.

Mrs W.

Aet. 25. Para 1.

10.5.24. Spontaneous delivery.

15.5.24. Temperature 105°. Fell to 103° during the day. Lochia normal.

16.5.24. Temperature 105°. Pulse 130. Blood culture - sterile.

17.5.24. Temperature 101°. Settled in 3 - 4 days.

Case 48.

Mrs T.

Aet. 31. Para 2.

13.5.24. Low forceps delivery on account of bad varicose veins.

16.5.24. Temperature 102°. Pulse 108-120. Lochia very foetid.

17.5.24. Temperature 102.6°. Blood-culture - abundant growth of long chained streptococci. Patient complained of flatulence, abdominal discomfort and difficulty in micturition.

20.5.24. Temperature 101°. Patient much better. Blood culture - sterile.

27.5.24. Temperature still irregular 100° - 101°. Complained of sore throat. Throat swab yielded a heavy growth of long chained Streptococci/

Streptococci along with a few Diphtheroids and Staphylococcus Albus.

29.3.24. Abscess in the left thigh opened. Pure culture of Streptococci obtained from the pus.

Patient's temperature continued to swing between normal and 100.5° for a fortnight longer, after which it gradually settled. She was then discovered to have a complete inversion of the uterus. As replacement was impossible, Hysterectomy had to be performed on 24.6.24. The patient made a smooth recovery.

The streptococci recovered from the blood, throat and abscess of this patient were all strongly haemolytic. They fermented Lactose, Salicin and Mannite and therefore belonged to the class S. Infrequens of Holman.

Intravenous injections into a rabbit of the growth on three blood agar slopes of the organisms from the patient's blood caused a general septicaemia and death within 5 days. Multiple abscesses were produced in the cortex of both kidneys and also in the myocardium. The same streptococci were recovered from the heart blood post mortem.

The/

The throat lesion, and the abscess must be looked on as metastases from the original focus of infection, i.e. the uterus. The organisms found in both lesions and in the blood were identical.

Case 49.

Mrs G.

Aet. 30. Para 1.

13.3.24. Spontaneous delivery. Quite well for 6 days.

20.3.24. Temperature rose to 103°. Lochia slightly foetid.

22.3.24. Temperature 99° in morning but rose to 102° in evening.

24.3.24. Temperature 103°. Pulse 140. Patient cyanosed. Slightly delirious. Blood culture - Profuse growth of Streptococci.

26.3.24. Sent to City Hospital.

28.3.24. Died. No Post-mortem.

The streptococci found here were of the same type as in the last case, i.e. they were haemolytic and fermented Lactose, Mannite and Salicin. But, though they were apparently more virulent for human beings than in the Case 48, intravenous injection of the organisms from 3 blood agar slopes into a rabbit caused death only after 11 days,/

days, and no organisms were recovered from the heart blood post-mortem. There were no macroscopic lesions in the organisms except marked enlargement of the spleen.

Case 50.

Mrs W.

Aet. 26. Para 1.

21.3.24. Spontaneous delivery.

25.3.24. Evening temperature 103°. Pulse 125.

26.3.24. Evening temperature 105°. Lochia slightly foetid.

27.3.24. Temperature 102°. Pulse 120. Blood culture - sterile.

Temperature settled in 3 - 4 days.

Case 51.

Mrs G.

Aet. 31. Para 8.

1.4.24. Vaginal Hysterotomy for repeated haemorrhage. Since then temperature swung between 98° and 103°. Pulse 100 - 120. No rigors. Urine normal.

4.4.24. Temperature 102°. Blood Culture - sterile.

8.4.24. and thereafter temperature normal.

Case 52.

Mrs McG.

Aet. 39. Para 2. 3 months pregnant.

4.4.24. profuse bleeding, therefore Pituitrin given. Spontaneous expulsion of the ovum.

7.4.24. Temperature 104°. Pulse 130. Continuous temperature. Average level 102°.

9.4.24. Temperature 102°. Pulse 116. Respirations 24. Cough with blood-stained sputum. Slight tenderness over Uterus, and scanty lochia. Blood culture - sterile.

14.4.24. Abscess at site of quinine injection ruptured. The pus was examined and found to contain a pure culture of Streptococci. These were haemolytic and fermented Lactose only. They were therefore of the type S. Anginosus. Temperature settled within 7 days.

Case 53.

Mrs S.

Aet. 23. Para 1.

5.4.24. Delivered instrumentally at home.

7.4.24. Temperature rose.

12.4.24. Admitted to Royal Infirmary Edinburgh. Temperature 103°. Pulse 120. Temperature/

Temperature fell immediately.

17.4.24. Temperature rose again and became of swinging type varying from 98° - 103°.

18.4.24. Temperature 98° - 103°.

19.4.24. Temperature 98° - 103°. Blood culture - sterile.

21.4.24. Temperature 104° in morning. Blood culture - sterile. Pelvic Cellulitis - Temperature settled within a week.

Case 54.

Elizabeth G.

Aet. 18. Para 1.

17.4.24. Spontaneous delivery.

21.4.24. Temperature 103°. Pulse 120. Temperature varied between 101° - 103°. Pulse 96 - 110.

3.5.24. Temperature 102°. Pulse 110. Blood culture - sterile.

8.5.24. Temperature settled.

Case 55.

Mrs S.

Aet. 36. Para 8. Abort. 4.

26.4.24. Spontaneous delivery.

28.4.24. Temperature rose. Irregular in type, 100 - 102°. Pulse 110 - 120. Double whiteleg.

8.5.24. 7 a.m. Rigor. Temperature 105°. Pulse 144. 10 a.m. Blood culture - sterile.

12.5.24. Temperature still irregular. Rigors at intervals. Blood culture - sterile.

14.5.24. 2 a.m. Rigor. Temperature 105°. 10 a.m. Blood culture - abundant growth of Gram negative coliform organisms. Patient drowsy, and jaundiced.

24.5.24. Died. No post-mortem.

The organisms were found to be motile. They fermented the following sugars in peptone water, producing Acid and Gas - Mannite, Dulcite, and Glucose strongly, Lactose very slightly. Saccharose and Inulin were not fermented. Lactose was definitely fermented on when the organisms were grown on McConkey's medium. There was no liquefaction of gelatin, acid and clot were produced in litmus milk, and indol was formed in peptone water. The organisms were therefore Bacillus Coli.

Case 56.

Mrs S.

Aet. 27. Para 1.

13.5.24. Instrumental delivery.

20.5.24. Evening temperature 102°. Pulse 120. Uterus well involuted. Lochia normal.

21.5.24. Morning temperature 102.6°. Pulse 130. Blood culture - sterile. Temperature settled in 3 - 4 days.

Case 57.

Mrs R.

Aet. 24. Para 1.

17.6.24. Spontaneous delivery. Perineal tear. Membranes ragged.

22.6.24. Temperature 103.8°. Pulse 140. Irregular temperature since then. Lochia scanty. Abdomen distended. Tenderness in Iliac Fossae.

2.7.24. Temperature 103°. Pulse 120. Blood culture - sterile.

7.7.24. Temperature 103°. Pulse 132. Blood culture - sterile.

14.7.24. Died. No post-mortem.

Case 58.

Mrs G.

Aet. 25. Para 2 (twins).

10.6.24. Delivered of twins. Membranes ragged.

23.6.24. Temperature irregular - 103° - 98°. Pulse 120 - 108.

2.7.24. Temperature 102.8°. Blood culture - sterile. Breasts engorged and painful. Small abscess in one.

7.7.24. Temperature settled.

Case 59.

Elizabeth S.

Aet. 30. Para 2.

4.6.24. Spontaneous delivery. Torn perineum. Membranes ragged.

9.6.24. Temperature 102°. Pulse 96. No further rise till 14.6.24.

14.6.24. Temperature 103°. Pulse 108. Temperature irregular in type. Varied from 98° - 104°. Pulse 90 - 130.

26.6.24. Temperature 104.6. Pulse 130. Blood culture - Streptococci.

27.6.24. Abscess in right thigh opened - Streptococci in pure culture in the pus. Patient gradually got worse. Slightly jaundiced. Very breathless.

9.7.24. Abscess in left wrist joint. Pus not obtained for examination.

12.7.24. Died. No post-mortem. The streptococci obtained from the blood and abscess in this case were non-haemolytic/

non-haemolytic. They fermented Lactose, Salicin and Mannite and were therefore of the type S. Faecalis.

Case 60.

Catherine M.

Aet. 20. Para 1.

Case of hyperemesis gravidarum, with marked jaundice. Also Congenital Syphilis.

20.6.24. Delivered 7 months foetus. Membranes ragged. Thereafter jaundice cleared up.

26.6.24. Small Perianal abscess opened - Streptococci and B. Coli in the pus. This soon healed.

1.7.24. Rigor. Temperature 103°. Pulse 110. Temperature slightly irregular but generally of the continuous type. Pulse 80 - 110. Lochia not foetid.

3.7.24. Temperature 103°. Blood culture - profuse growth of Gram negative coliform organisms.

4.7.24. Gram negative coliform bacilli and pus cells in the urine. Temperature still high.

9.7.24. Temperature settled by lysis. The organisms in this case were motile, did/

did not liquefy gelatin, produced indol in peptone water, formed acid and clot in Litmus Milk. They fermented the following carbohydrates, producing acid and gas when grown in peptone water containing them. - Glucose, Mannite, Dulcite, Lactose (very faintly). Saccharose and Inulin were not fermented. Lactose was distinctly fermented in McConkey's medium, however, as shown by the production of rose-red colonies by the organism when grown on this medium.

Case 61.

Mrs E.

Aet. 30. Para 1.

11.8.24. Transverse lie.
Delivered by version after labour lasting 2½ days. Temperature 102.4° at time of delivery.

12.8.24. Temperature rose in evening - 102°.
Pulse 130. Very foul lochia.

13.8.24. Temperature 103°. Blood culture - sterile.

14.8.24. Temperature 102°. 2 p.m. intrauterine douche given. Immediately after this was over a blood culture was taken - sterile.
Temperature continued to be irregular.

18.8.24. Patient died.

Case 62.

Mrs R.

Aet. 35. Para 4.

23.8.24. Admitted as 3 months incomplete septic abortion. Temperature 101.6°. Pulse 120. Had been bleeding for a week. Had had 2 rigors on 22.8.24.

Uterus evacuated. Found to contain blood clot and a 4½ months foetus in a complete amniotic sac. Intrauterine douche given and immediately afterwards a blood culture was taken. This was sterile.

24.8.24. Temperature 97° and remained so.

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## BIBLIOGRAPHY.


1. Andrewes and Horder: Streptococci Pathogenic to Man. Lancet 1906, p. 708.

2. Ahlfeld: Quellen u. Wege der puerperalen Selbstinfektion. Zeitschr. f. Geb. u. Gyn. 1913. Vol. 73, p.1.

3. Beck: Fatal case of Staphylococcus Albus Bacteraemia following Abortion. Am. J. Obst. N.Y. 78, 1918, pp. 476-479.

4. Benthin: Zur Behandlung des fieber haften Abortes. Zeitschr. f. Geb. u. Gyn. 1913, Vol.73, p.832.

5. Bjorkenheim: Zur Bakteriologie u. Therapie des fieberhaften Abortes. Archiv. f. Gyn. 1912, Vol.98, p.561.

6. Bondy: Klinische u. bakteriologische Beiträge zur Lehre vom Abort. Zeitschr. f. Geb. u. Gyn. 1912. Vol.70, p.417.

7. Also Scheidenkeime u. endogene Infektion. Zeitschr. f. Geb. u. Gyn. 1913. Vol.73, p.604.

8. Brodhead: Discussion on Polak's paper. Am. J. Obst. N.Y. 1918. 77, p.962.

9. Burckhardt: Sapr"amie oder Bakteri"amie, Archiv. f. Gyn. 1912. Vol. 95. p.551.

10. Bumm: Behandlung des Puerperalfiebers. Munch. med. Wchnschr. 1921. p. 1494.

11. Also discussion on Fromme's paper - Zeitschr. f. Geb. u. Gyn. Vol.70, p.343.

12. Bumm u. Sigwart: Zur Frage der Selbstinfektion. Archiv. f. Gyn. Vol. 97, 1912, p.613.

13. Burguburu: quoted by Schäfer. Archiv. f. Gyn. 1917, p.407.

14. Canon: quoted by Fromme. Archiv. f. Gyn. 1908. Vol. 85, p.154.

15. Döderlein: Das Scheidensekret u. seine Bedeutung für das Puerperalfieber. 1892.

16. Felty and Keefer: Bacillus Coli Sepsis. J. Am. Med. Assoc. May 3rd 1924. p.1430.

17. Foulerton and Bonney: A case of Primary infection of the Puerperal Uterus by Diplococcus Pneumoniae. Trans. of the Obst. Soc. Lond. 1903. Vol. XLV. p.128.

18. Franz: Verhandl. des Gesellschaft für Geb. u. Gyn. zu Berl. in Zeitschr. f. Geb. u. Gyn. 1914, Vol. 75, p. 765.

19. Fricke: Quoted by Williams in his text-book,p.950

20. Friedrich: Zur Kenntnis der Saprämie und Bakteriämie bei fieberhaften Aborten. Archiv. f. Gyn. 1912. Vol. 95, p.571.

21. Fromme: Klinische und bakteriologische Studien zum Puerperalfieber. Archiv. f. Gyn. 1908, Vol. 85, p.154.

22. Also Die Therapie des fiebernden Abortes. Zeitschr. f. Geb. u. Gyn. Vol. 70, p.343.

23. Gordon: Lancet 1905, II, p.1400.

24. Halban: Zur Behandlung der Fehlgeburten, Zentralbl. f. Gyn. 1921. No.12, p.439.

25. Halban u. Köhler: Die pathologische Anatomie des Puerperalprozesses und ihre Beziehungen zur Klinik und Therapie. (Braumüller Wien, 1919).

26. Halle: Quoted by Bondy, Zeitschr, f. Geb. u. Gyn. 1912, Vol. 70, p.417.

27. Heberer: Zur Behandlung des fieberhaften Abortus. Zentralbl. f. Gyn. 1921, p.859.

28. Herz: Behandlung des fieberhaften Abortus. Archiv. f. Gyn. 1920. 112, p.273.

29. Hiss and Zinsser: Textbook of Bacteriology, p.453.

30. Holman: Classification of Streptococci. J. Med. Research, 1916, 34. p.377.

31. Houlton: Investigation of the Bacteria of the Vagina in Pregnancy. J. Obst. & Gyn. Brit. Emp. Vol. 31, p.258.

32. Kanter and Pilot: Haemolytic Streptococci and their relation to Pregnancy and the Puerperium. Surg. Gyn. and Obst. Chicago. 1924. No.1, p.96.

33. Koch: Quoted by Schäfer. Archiv. f. Gyn. 1917, p.407.

34. Krönig u. Menge: Quoted by Schäfer. Archiv. f. Gyn. 1917, p.407.

35. Lamers: Ueber die Hämolyse der Streptokokken in Scheidensekret Schwangerer und Wöchnerinner. Archiv. f. Gyn. 1912. Vol. 95, p.74.

36. Also Anaerobe Blutkulturen bei Puerperalfieber Infektion und Fäulnis. Zeitschr. f. Geb. u. Gyn. 1911. Vol.68, p.88.

37. Latzko: Die Behandlung des fieberhaften Abortus. Zentralbl. f. Gyn. 1921. No.12, p.425.

38. Lenhartz: Quoted by Fromme. Archiv. f. Gyn. 1908, p.182.

39. Lindig: Zentralbl. f. Gyn. 1920. Vol. 44, p.430.

40. Loeser: Ist jeder puerperale Uterus infiziert? Zeitschr. f. Geb. u. Gyn. Vol.82, 1920, p.577.

41. Also Die latente Infektion der Geburtswege. Archiv. f. Gyn. 1918, Vol. 108, p.137.

42. Marquis: Staphylococcus and B. Coli infections in the puerperium. Annales de Gynec. 1908, V. p.207.

43. Miller and Chalfant: Treatment of puerperal blood infections with Arsenobenzol, Report of cases. Am. J. Obst. N.Y., 1918, Vol.78, pp. 395 - 404.

44. Moody: Bacteriology of systemic infections causing death following miscarriage or abortion. Trans. Chic. Path. Soc. 1919-22, XI, pp.279-284.

45. Muir and Ritchie: Manual of Bacteriology, p.82.

46. Natvig: Bakteriologische Verhältnisse in weiblichen Genital sekreten. Archiv. f. Gyn. 1905. Vol. 76, p.701.

47. Offermann: Beitrag zur Behandlung des Fieberhaften Abortes. Zeitschr. f. Geb. u. Gyn. 1922. Vol. 84, p.356.

48. Philipp: Zur Arteinheit der Streptokokken. Archiv. f. Gyn. 1924. Vol.121. p.320.

49. Polak: Puerperal Pelvic Infection. Am. J. Obst. N.Y. 1918. 77, pp. 916-927 and 962-972.

50. Also Pathology of common Puerperal Lesions. Am. J. Obst. & Gyn., St Louis, 1920. I. pp. 547-559.

51. Also quoted by Miller and Chalfant. Am. J. Obst. N.Y. 1918, Vol.78, p.395.

52. Poten: Frequency and importance of Spontaneous infection in the Puerperium. Archiv. f. Gyn. 1920. Vol. 113, p.316.

53. Ruge: Neue Methode zur Virulenzbestimmung der Streptokokken. Archiv. f. Gyn. 1923, Vol. 120, p.5.

54. Also Studien zur Virulenzprugung der Streptokokken. Archiv. f. Gyn. 1924. Vol. 121, p.363.

55. Sachs: Discussion of Warnekros' paper - Zeitschr. f. Geb. u. Gyn. 1922. Vol. 84, p.560.

56. Also Münch. med. Wchnschr. 1911, No.7, p. 348.

57. Also Bakteriologische Untersuchungen beim Fieber während der Geburt. Zeitschr, f. Geb. u. Gyn. 1912. Vol. 70, p.222.

58. Salomon: Die endogene (Spontan-) Infektion in der Gynäkologie. Archiv. f. Gyn. 1921, Vol. 114, p.105.

59. Schäfer: Zur Behandlung des Puerperalfiebers. Archiv. f. Gyn. 1917, Vol. 107, p.109.

60. Also Zur Frage der Selbstinfektion. Archiv. f. Gyn. 1917, p. 407.

61. Schmidt: Zur Frage der Selbstinfektion. Archiv. f. Gyn. 1909. Vol. 89. p. 118.

62. Also Zur Verhütung des Kindbettfiebers Zeitschr. f. Geb. u. Gyn. 1921. Vol. 83, p. 335.

63. Schottmüller: Streptokokken aborte und ihre Behandlung. Münch-med. Wchnschr. 1911, Nos. 39, 40, 41, pp. 2051, 2123, and 2170.

64. Also Zur Aetiologie des Febris puerperalis und Febris in puerperio. Münch. med. Wchnschr. 1911, No.11, p.557.

65. Schottmüller: Also Zur Pathogenese des septischen Abortes. Münch. med. Wchnschr. 1911, No. 35, p. 1817.

66. Also Endocarditis Lenta - Artunterscheidung der pathogenen Streptokokken. Münch. med. Wchnschr. 1910. Nos. 12 and 13. pp. 616 and 696.

67. Also Münch. med. Wchnschr. 1903, p. 849.

68. Sternberg: Ein Beitrag zur Wesen der Saprophyten des weiblichen Genitalkanals. Zeitschr. f. Geb. u. Gyn. 1922. Vol. 84. p. 447.

69. Traugott: Aktive und konservative Behandlung des Streptokokkenaborts und ihre Resultate. Zeitschr. f. Geb. u. Gyn. 1914, Vol. 75, p. 375.

70. Walthard: Archiv. f. Gyn. 1895, Vol. 17, pp.201-269.

71. Also Zeitschr. f. Geb. u. Gyn. 1905. LIV, pp. 304-442.

72. Walthard und Reber: Beiträge zur Kenntniss der Natur und der klinische Bedeutung der Vaginal streptokokken. Zeitschr. f. Geb. u. Gyn. 1905, p. 304.

73. Warnekros: Puerperale Pyämie. Archiv. f. Gyn. 1912, Vol. 97, p.27.

74. Also Discussion of Sigwart's paper, Zeitschr. f. Geb. u. Gyn. 1914. Vol.75, p. 765.

75. Also Zur Prognose und Therapie der Puerperale Pyämie. Zeitschr. f. Geb. u. Gyn. 1922. Vol. 84, p.560.

76. Also Zur Ligatur der grossen Beckenvenen bei puerperalen Infektionen. Münch. med. Wchnschr. 1921. LXVIII. 1545-1547.

77. Warnekros: Also Zur Frage der Behandlung des fieberhaften Abortes. Archiv. f. Gyn. 1912, Vol. 98, p. 600.

78. Watson, B.P.: Treatment of Puerperal Infections. B.M.J., Mar. 24th, 1923.

79. Wegelius: Bakteriologische Untersuchungen der weiblichen Genitalsekrete während der Entbindung und des Wochenbettes, mit besonderer Berücksichtigung der Frage von der puerperalen Selbstinfektion. Archiv. f. Gyn. 1909. Vol. 88, p.249.

80. Werner und Zebrzycki: Bericht über bakteriologische Untersuchungen bei 200 Fällen von Fieber nach der Geburt. Zeitschr. f. Geb. u. Gyn. 1914. Vol. 75.

81. Widal and Lemierre: Quoted by Marquis. Annales de Gynéc. 1908, Vol. V. p. 207.

82. Williams: Obstetrics. pp. 948-949.

83. Also Post-abortal haemolytic Septicaemia. Am. J. Obst. and Gyn. St. Louis. 1922, IV, pp.636-645.

84. Winter: Die Prognose und Behandlung des septische Aborts. Zentralbl. f. Gyn. 1911, No.15.

85. Also Schlusswort über die Behandlung des fieberhaften Abortes. Archiv. f. Gyn. 1923. Vol. 120, p.17.

86. Report of the Scottish Departmental Committee on Puerperal Morbidity and Mortality.

---

52. Polen, Frequency & importance of Spontaneous infection in the Puerperium
Archiv f Gyn 1920 Vol 113 p 316.

58. Salomon, Die endogene (Spontan-) Infektion in der Gynakologie.
archiv. f. Gyn. 1921. Vol. 114 p 105.

59. Schäfer. Zur Behandlung des Puerperalfiebers. Archiv f Gyn 1917 Vol 107 p 109.

60. Schäfer. Zur Frage der Selbstinfektion
archiv f Gyn 1917 p 407.

61 Schmidt - Zur Frage der Selbstinfektion
archiv f Gyn 1909 Vol 89 p 118.

62. Schmidt - Zur Verhütung des Kindbettfiebers
Zeitschr f Geb u Gyn 1921 Vol 83. p 335.

Jessie Eeles.

p 71. Ref. Fromme. 21.
Erysipelas followed by premature labour
Fatal puerperal sepsis
"Klinische und bakteriologische Studien zum Puerperalfieber. Archiv. f. Gyn 1908. vol 85 p154.

p 71. Schmidt 61. Streptococcal Cases with primary tonsillar infection.
"Zur Frage der Selbstinfektion.
archiv. f. Gyn. 1909 vol 89 p118.

p 27. Ruge. 53 + 54.
method of estimating the virulence of an organism for the patient from whom it has been isolated.
Mix 2 or 3 loopfuls of the Streptococcus containing lochia with ½ cc defibrinated blood from patient + incubate.
Examine a loopful at a time at intervals from hour comparing the no's Organisms in the litre in each Case + gives the prognosis from the date of Destruction.

Ruge: Neue Methode zur Virulenzbestimmung der streptokokken. Archiv f. Gyn 1923 vol 120 p 5.

Ruge Studien zur Virulenzprüfung der Streptokokken. Arch f Gyn 1924 vol 121 p363.

16. Kelly & Keefer. Bacillus Coli Lepsis J. Am. Med Ass
May 3rd 1924. p 1430.

17. Fowlerton & Bonney. a case of Primary Infection
of the Puerperal Uterus by Diplococcus Pneumoniae
Trans. of the Obst. Soc Lond 1903 Vol XLV p 128.

18. Franz. Verhandl. des Gesellschaft für Geb.
u. Gyn. zu Berl in Zeitschr f. Geb u
Gyn 1914 Vol 75 p 765

19. Fricke. Quoted by Williams in his textbook p 950

20. Friedrich. Zur Kenntnis der Saprämie und
Bacteriämie bei fieberhaften. Archiv. f.
Gyn ~~1908 Vol 85 p 154~~ 1912 Vol 95 p 571.

21. Fromme. Klinische und bakteriologische Studien
Zum Puerperalfieber. Archiv. f Gyn 1908.
Vol 85. p 154.

22. " Also Die Therapie des fiebernden Aborts
Zeitschr f. Geb. u Gyn Vol 70 p 343

23. Gordon Lancet 1905 II. p 1400

24. Halban. Zur Behandlung der Fehlgeburten
Zentralbl. f Gyn 1921 N° 12 p 439

25. Halban u Köhler Die Pathologische Anatomie
des puerperal prozesses und ihre Beziehungen
Zur Klinik und Therapie (Braumuller Wiem
1919).

# BIBLIOGRAPHY.


1. Andrewes and Horder: Streptococci Pathogenic to Man. Lancet 1906, p. 708.

2. Ahlfeld: Quellen u. Wege der puerperalen Selbstinfektion. Zeitschr. f. Geb. u. Gyn. 1913. Vol. 73, p. 1.

3. Beck: Fatal case of Staphylococcus Albus Bacteraemia following Abortion. Am. J. Obst. N.Y. 78, 1918, pp. 476-479.

4. Benthin: Zur Behandlung des fieber haften Abortes. Zeitschr. f. Geb. u. Gyn. 1913, Vol. 73, p. 832.

5. Bjorkenheim: Zur Bakteriologie u. Therapie des fieberhaften Abortes. Archiv. f. Gyn. 1912, Vol. 98, p. 561.

6. Bondy: Klinische u. bakteriologische Beiträge zur Lehre vom Abort. Zeitschr. f. Geb. u. Gyn. 1912. Vol. 70, p. 417.

7. Also Scheidenkeime u. endogene Infektion. Zeitschr. f. Geb. u. Gyn. 1913. Vol. 73, p. 604.

8. Brodhead: Discussion on Polak's paper. Am. J. Obst. N.Y. 1918. 77, p. 962.

9. Burckhardt: Saprämie oder Bakteriämie, Archiv. f. Gyn. 1912. Vol. 95. p. 551.

10. Bumm: Behandlung des Puerperalfiebers. Munch. med. Wchnschr. 1921. p. 1494.

11. Also discussion on Fromme's paper - Zeitschr. f. Geb. u. Gyn. Vol. 70, p. 343.

12. Bumm u. Sigwart: Zur Frage der Selbstinfektion. Archiv. f. Gyn. Vol. 97, 1912, p. 613.

13. Burgeburu. quoted by Schäfer Archiv. f. Gyn 1917 p 407.

14. Canon quoted by Fromme archiv f Gyn 1908. Vol 85 p 154.

15. Doderlein. Das Scheidensekret u. seine Bedeutung fur das Puerperalfieber 1892.